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Literacy Utilization in Canadian Workplaces

INTERNATIONAL ADULT LITERACY SURVEY
IALS
EIAA
ENQUÊTE INTERNATIONALE SUR L'ALPHABÉTISATION DES ADULTES

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Literacy Utilization in Canadian Workplaces

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Editor's note

Most economic analysis of data from the International Adult Literacy Survey has focused on the supply of literacy skills, particularly on the causes and consequences of the putative literacy skill deficit on individual workers and the Canadian economy as a whole.

In this paper, Krahn and Lowe employ the same data to explore the possibility that the Canadian labour market may also suffer from a deficit in the demand for skill. The existence of such a deficit would have important implications for policy. Given this fact, it is worth noting several limitations in the underlying data and analyses which should guide and inform future research on this important topic.

First, there is the issue of how representative the reading behaviours sampled by IALS are of the universe of reading behaviours in the workplace. Data from HRDC's Essential Skills Research Project, which examines the reading requirements in a sample of entry-level jobs, suggests that the IALS questions capture some of the major dimensions of on-the-job reading. The possibility remains, however, that the survey questions exclude reading tasks which are important to labour market success. To the extent that this is true, the analysis in this paper will under or overstate the posited skill fit-mismatch.

Second, the IALS instruments only probed the incidence and frequency of reading and numeracy behaviours, ignoring the dimension of criticality. Recent literature on reading at work, as well as HRDC's Essential Skills Research Project, suggests that infrequent reading and numeracy behaviours may be critical to job performance, whereas frequent behaviours, such as reading reports, may have relatively little impact on performance. This fact raises the possibility that the IALS data on the incidence and frequency of these behaviours misrepresent their true importance. A similar case can be made with regard to task complexity, which was not measured in the IALS questions on reading and numeracy behaviours. To the extent that these factors have an impact, the Krahn and Lowe analysis will under or overstate the magnitude of the posited skill fit-mismatch.

Finally, it is not clear that the IALS questions fully support the simple summated rating scale constructed by the authors. For example, to sum the product of incidence by frequency it is crucial that the points are equidistant, that is, for example, that the differences between reading daily and reading several times a week is the same as the difference between reading once a week and reading less than once a week. This is important as many different reading patterns may produce the same index score. In similar analyses, other authors, such as Jones (Chap.4, OECD/ Statistics Canada 1995; Chap. 3, Statistics Canada 1996) and Smith (Smith 1996), have employed a reduced form of the index to avoid some of the potential problems associated with the imperfect statistical properties of the data.

Having listed these measurement caveats, it should be noted that analysis of the IALS data does show systematic variation across industry, occupation, and education categories as one would expect from reasonably valid measures of reading behaviours. Krahn and Lowe's juxtaposition of these measures with measures of literacy skill raises some provocative questions about the Canadian labour market that should inspire further research and considerable policy debate.

Table of contents

List of tables

List of figures

> *We have come to recognize that literacy is linked with virtually all aspects of our national life, public and private. It is a passport to employment and a key ingredient to a fulfilling life. And without requisite literacy ... we can neither survive as a democratic nation nor prosper as an economic power. (Bruner 1991, viii)*

> *Your brain gets slow. It doesn't function the way it should. You do the same thing day in and day out and your brain goes. I'm like a robot. I walk straight to my job and do what I have to do. (Canadian autoworker, quoted by Robertson and Wareham 1987, 29).*

Introduction

The ability to read, write and use numerical information is crucial for labour market success and social well-being. Research has shown clearly that inadequate literacy skills reduce an individual's employment prospects and limit her or his opportunities to participate fully in society (Power 1983; Centre for Educational Research and Innovation [CERI] 1992; OECD/Statistics Canada 1995, 13). Also, it is widely accepted that societies with highly literate populations will be more competitive. The argument goes that success in today's global economy requires skilled workers capable of continually learning and adapting to change (Maynard 1989; Chisman 1990; Chisman and Campbell 1990; Bruner 1991; CERI 1992; OECD/Statistics Canada 1995; Statistics Canada 1996; Clark 1996). Thus, literacy is central to policy discussions about human resource development and usage at the individual, workplace and national levels.

Yet little systematic research has been done in Canada, or elsewhere for that matter, on how workers actually use their literacy skills in their jobs. Previous research has focused mainly on individuals' literacy "deficits" and the need for remedial training (Chisman 1990; Chisman and Campbell 1990; Bassi 1992; Hollenbeck 1993). Missing are a broader perspective and research agenda that focus not only on such individual deficits, but also on the literacy requirements of jobs. The main objective of this report, then, is to fill this research gap. Specifically, we examine the fit or mismatch between the job requirements of Canadian workers and their literacy skills, thus profiling patterns of literacy usage and under-usage in the Canadian labour market.

To do so, we analyze data from the Canadian component of the International Adult Literacy Survey (IALS), an innovative cross-national study that offers many unique research opportunities. For our purposes, careful measurement of three types of literacy (prose, document and quantitative literacy), inclusion of (self-reported) measures of workplace literacy use along with a wide range of other critical control variables, and a reasonably large national sample make this an ideal research vehicle to examine patterns and consequences of literacy usage and under-usage (*see* Appendix A, which describes the sampling, data collection and measurement strategies used in the IALS).[1]

Initial IALS findings underscore the importance of literacy for individual economic success. There are large income "penalties" and "bonuses" for low and high literacy levels, respectively, in Canada and the United States (Statistics Canada 1996, 54–55). But the IALS results also hint at possible under-usage of literacy skills. For example, international comparisons suggest that some Canadian workers—notably those in skilled craft occupations—have fewer opportunities to use their literacy skills on the job (Statistics Canada 1996, 61; Crompton 1996, 20). In this report, we focus much more systematically on the issue of literacy under-usage, arguing that it has serious

implications in an economic environment that increasingly rewards skill acquisition and life-long learning.

In fact, the IALS has drawn attention to the argument that, if literacy skills are not used, they could be lost. *Literacy, Economy and Society* (OECD/Statistics Canada 1995, 116) observed "[f]ormal education provides only the raw material for adult literacy. The evidence shows that the lack of application of literacy in daily life is associated with lower levels of performance" (*see also* Crompton 1996, 19). This study also noted that some growth industries, like finance, "create environments that reinforce literacy." *Reading the Future* (Statistics Canada 1996, 42) asserts that "if jobs are not designed to promote literacy skills by asking workers to use their skills, then the workers will inevitably end up with lower levels of literacy." This assumption has also entered the policy arena, as expressed recently by Human Resources Development Canada: "Literacy practices at home and in the workplace are crucial to literacy. Like physical fitness, 'literacy fitness' requires continual practice. What you don't use you lose," (Human Resources Development Canada 1996, 18). This proposition—the "use it or lose it" hypothesis—is the second main focus of this report.

We begin with an overview of research findings and policy debates from several different areas. The first section of this literature review shows how debate about the "adult literacy problem" has shifted as concerns about economic competitiveness have come to dominate public policy discussions. Even so, the debate continues to centre on the need to improve the literacy skills of Canadian workers. We argue that similar attention should be paid to the literacy requirements of jobs in Canadian workplaces.

Having situated discussions of adult literacy within the human resource development literature, we then focus directly on our core argument, namely, that an individual's work environment can inhibit or enhance skill development as well as social and psychological well-being. After introducing findings from a number of quite different research traditions to make this point, we present our analyses of the IALS data. These were guided by four seemingly simple questions:

1. What is the distribution of prose, document and quantitative literacy skills among the currently employed in Canada?
2. To what extent do Canadian workers use their literacy skills on the job? That is, what is the "fit" or "mismatch" between workers' literacy skills and their literacy needs in the workplace?
3. How do these patterns of fit and mismatch vary by gender, age, educational attainment, industry, occupation and employment status?
4. Among workers who show a "literacy surplus" (i.e., their literacy skills are substantially greater than their job requirements), is there any evidence that their skills may decline after prolonged under-usage?

The answers to these seemingly simple questions are complex. In fact, because the IALS data are not longitudinal, we cannot really provide a definitive answer to our fourth question about possible skill atrophy. Even so, the IALS data open up new opportunities for examining literacy usage in the Canadian work force, and the resulting analyses of literacy fit and mismatch raise critical policy questions. Also, the test of the "use it or lose it" hypothesis, although not conclusive because of the design of the IALS, does hint at some powerful processes whereby jobs affect those in them. Together, the analyses of literacy fit and mismatch and the test of the literacy loss argument are important first steps in what should become a longer-term agenda for research into workplace literacy.

Chapter 1

Literature review

Workplace literacy as a human resource development issue

Concerns about the "adult literacy problem" are not new. Adult illiteracy was labeled a *social problem* early this century when, for example, volunteers from Frontier College taught workers in Canada's resource industries how to read and write. Then, as now, it was recognized that adults with limited literacy skills were much less likely to find satisfactory employment and, consequently, to enjoy a reasonable standard of living and some control over their lives (Power 1983; Chisman 1990). Furthermore, because such individuals were usually less informed as citizens, they risked being marginalized in the democratic process (Chisman 1990, 5; Bruner 1991, viii; Damon 1991, 34; CERI 1992, 13).

In Canada, the Southam Literacy Survey in 1987 (Calamai, 1987) sparked renewed interest in adult literacy. However, it was Statistics Canada's 1989 Survey of Literacy Skills Used in Daily Activities (LSUDA) that provided the first reliable estimates of national patterns of adult literacy (Statistics Canada 1990; Montigny 1990; Montigny and Jones 1990; Boyd 1992; Kelly, Montigny, O'Neill and Sharpe 1992). Concerns about the substantial number of adult Canadians with relatively limited literacy skills quickly surfaced, as did criticisms of the education system (e.g., Maynard 1989). The Economic Council of Canada (1992) predicted that, without educational reform, Canada could not remain competitive in the global economy. It warned that that "[i]f these figures do not improve, our school system will produce well over 1 million new functional illiterates over the next 10 years" (Economic Council of Canada 1992, 8).

Similar concerns about adult literacy as a competitiveness problem and a tendency to focus on the failure of the education system are apparent in the United States (Chisman and Campbell 1990). There some observers have called adult literacy a "life-and-death economic issue" (Chisman 1990, 6). Thus, recast as an *economic problem*, adult literacy has become part of North American debates about the role of human capital and human resources in national economic competitiveness. But although employers are typically assumed to be responsible for human resource development, the corporate sector continues to expect the education system to solve the literacy "deficit" problem (Chisman and Campbell 1990, 15). However, even with an aging work force, it is simply not possible to replace large numbers of less literate, older workers with a new cohort of better-educated, more literate, younger workers (CERI 1992, 15). Upgrading the skills of current workers would be much more efficient (Chisman 1990, 12).

The level of literacy required of adults today has, in fact, increased, because of the rapidly changing economic and technological environment (CERI 1992, 13; Crompton 1996, 14; Lowe 1997). Some observers detect a growing "job-skills gap" as new computer-based technologies and management systems require more intensive information-processing and decision-making skills. A few even recommend that the definition of workplace literacy be extended beyond basic reading, communication and numeracy skills to include working and learning independently, team-work, flexibility, multi-tasking and research skills (Chisman and Campbell 1990, 145-6).[2] The Conference

Board of Canada's (1993) frequently cited *Employability Skills Profile: What are Employers Looking For?* takes a somewhat different approach. It proposes that literacy is a core skill around which other types of diverse technical and social skills are clustered.

But other labour market analysts remind us that many jobs in the new service-based economy require relatively few complex skills (Economic Council of Canada 1990; Krahn 1992). As one United States researcher put it, "despite the endless rhetoric about how the jobs of the year 2000 will need employees with much higher levels of literacy, ... [t]he greatest future demand in the labor market appears to be for armed guards, fast-food preparation personnel, truck drivers, sanitation workers, nurses' aides, and other relatively unspecialized tasks" (Csikszentmihalyi 1991, 122–3). Many well-educated, literate young workers are having difficulty finding employment outside this low-wage, part-time segment of the labour market (Morissette, Myles and Picot 1994; Krahn 1995), raising the possibility of a "job-skills gap" of a different kind. As Daniel Boothby (1993) observed after analyzing the 1989 LSUDA data, about 3.5 million Canadians with decent reading skills are in jobs that do not appear to take full advantage of these skills.

Although the term *underemployment* is sometimes used to indicate insufficient hours or weeks of work, it also aptly describes the under-usage of skills (Redpath 1994; Statistics Canada 1997). We use this term in the latter sense in this report, at the same time recognizing that literacy skills are not the only skills needed in the workplace. In our view, this form of underemployment—we might also call it a *literacy surplus* problem—should concern us every bit as much as the *literacy deficit* problem (inadequate levels of literacy among workers) that has captured more public attention in the past decade. Both problems should be addressed within the same *fit–mismatch* framework. At one end of the continuum are workers whose literacy skills fall well below the minimum requirements in most jobs. At the other end are the highly literate employed in jobs that frequently under-use their skills. In the first case, potential human resources are not being developed. In the second, the human capital residing in the labour force is not being optimally used. As a result, some of it may be lost (Krahn 1997).

In fact, if we return to the LSUDA's findings, we note that less-literate workers were over-represented in agriculture and manufacturing and in seasonal employment (Statistics Canada 1990). This finding could be the result of occupational self-selection (*see* Frese 1982), that is, the process whereby those with few skills seek employment in low-skill industries. However, for some the pattern might also reflect the loss of skills from extended employment in jobs requiring few skills. Similarly, although much of the explanation of lower literacy among older workers can be traced to lower educational attainment among older cohorts (CERI 1992, 14), some of the age variation in literacy may also result from skill atrophy among those who have not had the opportunity to use their skills extensively.[3] Thus, restating our point, we believe it is essential to focus, not only on individuals with skill deficits, but also on those with skill surpluses and employed in jobs with skill deficits.

By framing our discussion of adult literacy in this manner, other important connections with human resource development issues become highly visible. Many observers have argued that Canadian employers do not provide enough on-the-job training for their workers (Sharpe 1990; Betcherman 1993; Canadian Labour Market and Productivity Centre 1993; Crompton 1994; Human Resources Development Canada 1997). As a result, it is argued, Canadian workers' skills are not on par with those of either Japanese or German workers. This argument is compelling. It becomes even more convincing when we raise the possibility that a consequence of not training employees may be the loss of human capital in the form of under-used skills, including literacy.

Similarly, the concepts of "life-long learning" and "learning organizations" (Senge 1990) have come to be equated with national competitive advantage (Ontario Premier's Council 1990; Economic Council of Canada 1992). This emphasis on continually developing human resources suggests that organizations must encourage learning among all employees, regardless of their level of education or other job-relevant skills. The implications for workplace literacy programs are plain enough. Employers need to adopt a more holistic perspective, recognizing that it is not

just a small group of workers with literacy deficits who need attention, even though such workers may require more tailor-made remedial programs. Instead, all workers, including those with well-developed literacy skills, would benefit from a work environment that provides on-going opportunities to practice and expand such skills. By definition, the absence of such a "learning culture" results in less learning. Furthermore, it might mean that some previously acquired skills, including literacy, are slowly being lost.

To be fair, while focusing primarily on solutions to literacy deficits among workers, the literature on literacy in the workplace has begun to take a more holistic approach by advocating the use of "customized curriculum" (Fingeret 1990, 27) and "contextual instruction" (Chisman and Campbell 1990, 148). The most successful workplace literacy programs use workers' own interests and experiences as the source material and context for learning (Alamprese 1990, 106; CERI 1992). Workers are more motivated to learn when learning will assist them in meeting a personal goal or perform an essential task (Chisman and Campbell 1990, 148).Thus, employers can play an active role in promoting workplace literacy, both by offering formal programs for those with literacy deficits and by creating environments that encourage and reward employees at all skill levels to maintain and enhance their skills. This growth is the essence of human resource development.

We have been developing the general argument that a work environment has the potential to enhance the skills of workers, but it can also allow the loss of such skills, if they are under-used. Already the first proposition can be recognized in both the human resource development and workplace literacy literature, but neither have paid as much attention to the second proposition, which focuses on potential skill loss. However, as our review indicates, extensive research in social science links employment conditions to workers' learning and skills, as well as to their social and psychological well-being. The literature suggests that either positive or negative outcomes could be expected, depending on the characteristics of an individual's job.

The dehumanizing effects of routine work

A number of the classical social and economic theorists argued that working conditions can either enhance skill development or lead to a loss of skill—to the point of denying individuals their essential humanity. More than 200 years ago, Adam Smith's book *An Inquiry into the Nature and Causes of the Wealth of Nations* identified a more complex division of labour as a prerequisite for increasing national productivity and growth. Yet Smith also expressed concerns about the effects of routine and repetitive tasks on workers. As he put it:

> The man whose whole life is spent in performing a few simple operations, of which the effects too are, perhaps, always the same, or very nearly the same, has no occasion to exert his understanding, or to exercise his invention in finding out expedients for removing difficulties which never occur. He naturally loses, therefore, the habit of such exertion, and generally becomes as stupid and ignorant as it is possible for a human creature to become. The torpor of his mind renders him, not only incapable of relishing or bearing a part in any rational conversation, but of conceiving any generous, noble, or tender sentiment, and consequently of forming any judgment concerning many even of the ordinary duties of private life. (Smith 1937, 734)

If the father of modern economics was uneasy about the human costs of industrial production methods, later critics such as Karl Marx saw capitalist employment relations as essentially dehumanizing. For Marx, the alienating circumstances of capitalist production resulted in a loss of physical and mental skills. An alienated worker "does not fulfill himself in his work but denies himself, has a feeling of misery, not of well-being, does not develop freely a physical and mental energy, but is physically exhausted and mentally debased" (quoted by Bottomore and Rubel 1956, 177).

Writing at the end of the 19th century, the French social theorist Émile Durkheim saw significant economic and social benefits in the increasing industrial division of labour. Still, he also identified variants of this general pattern that had the potential to degrade workers:

> [The division of labour] has often been accused of degrading the individual by making him a machine. And truly, if he does not know whither the operations he performs are tending, if he relates to them no end, he can only continue to work through routine. Every day he repeats the same movements with monotonous regularity, but without being interested in them, and without understanding them. He is no longer a living cell of a living organism .... He is no longer anything but an inert piece of machinery, only an external force set going which always moves in the same direction and in the same way. (Durkheim 1964, 371)

Twentieth-century industrialization has been accompanied by rising educational levels and job skill requirements (Hunter 1988; Myles 1988; Clement and Myles 1994). Worker literacy levels have also risen. So it is from this higher base of education and skill that we must judge the extent to which workers today are able to use their skills. In broad terms, then, the issue of worker dehumanization first raised by Smith, Marx and Durkheim can be rephrased in the context of the late-20th century service economy as the under-use of human resources. In today's labour market, with its growing polarization between "good jobs" and "bad jobs" (Economic Council of Canada 1990; Krahn 1992; Betcherman and Lowe 1997), questions about the fit or mismatch of workers' skills with their job requirements have considerable urgency. So too do questions about the long-term consequences of skill loss for individuals and human capital loss for society as a whole (Krahn 1997).

Job conditions and psychological functioning

Social and economic philosophers have theorized that poor working conditions can have dehumanizing effects, but is there any empirical evidence for this proposition? The answer is clearly "yes." For several decades, researchers in the sociology of work have built up an impressive range of evidence documenting the effect of working conditions on individuals. According to this perspective, "occupational socialization" exerts powerful influences on individual worker's attitudes and behaviour. Thus, although some workers may appear to opt for routine work because all they care about in a job is the money (an "occupational self-selection" hypothesis; *see* Frese 1982), occupational socialization would interpret these instrumental work orientations as an adaptation to limited job rewards. In short, there is evidence of "the long arm of the job" (Meissner 1971) affecting how workers think and act.

The most conclusive evidence comes from research by Melvin Kohn and his colleagues (Kohn 1969, 1989, 1990; Kohn and Schooler 1982, 1983, 1986; Schooler 1984; Miller, Kohn and Schooler 1985; Spenner 1988; Kohn and Slomczynski 1990; Kohn, Naoi, Schoenbach, Schooler and Slomczynski 1990; *see also* Mortimer, Lorence and Kumka 1986). By tracking different groups of workers over a decade or more, these researchers showed that individuals whose work allows self-direction (i.e., is not closely supervised, allows independent judgment, is complex and non-routine) become more self-confident, less conforming, less fatalistic and more flexible in dealing with ideas. Thus, rather than self-selecting themselves into jobs that fit their prior work orientations, workers' attitudes, cognitive skills and personalities are directly shaped by their jobs.[4]

Highly relevant to our more specific argument about employment conditions and worker literacy is Carmi Schooler's (1984) more general theory that individuals who have the opportunity to participate in cognitively challenging activities will become more self-directed and intellectually motivated and more cognitively flexible. As Schooler explained:

> [T]he complexity of an individual's environment is defined by its stimulus and demand characteristics. The more diverse the stimuli, the greater the number of decisions required, the greater the number of considerations to be taken into account in making these decisions, and the more ill-defined and apparently contradictory the contingencies, the more complex the environment. To the degree that the pattern of reinforcement within such an environment rewards cognitive effort, individuals should be motivated to develop their intellectual capacities and to generalize the resulting cognitive processes to other situations. (Schooler 1984, 259–60)

Schooler also proposed that the reverse could occur in non-challenging environments, leading to a loss of some of these positive attributes and skills.

On the other hand, values, orientations and behaviours that are adaptive in complex environments may be maladaptive in simpler ones. Simple environments may not provide sufficient rewards to insure the development or continuance of relatively high levels of cognitive functioning and self-directedness. Consequently, continued exposure to relatively simple environments may result in a decrement in intellectual functioning and a change in values, orientations, and behaviours in keeping with the level of environmental demand. (Schooler 1984, 260).

Schooler and her colleagues have used sophisticated statistical techniques to show that changes in job complexity influence the intellectual functioning of workers (Kohn and Schooler 1982; 1983). These analyses reveal that increases in environmental complexity result in improved intellectual flexibility. In turn, decreases in occupational self-direction lead to declines in intellectual flexibility. The closest this research tradition comes to addressing adult literacy is in connecting working conditions and leisure activities.[5] Miller and Kohn (1983), for example, found that the complexity of an individual's job also influences her or his choice of leisure-time activities. This finding is consistent with a wide range of other studies (e.g., Meissner 1971; Piotrkowski 1978; Karasek and Theorell 1990, 53). As Schooler (1984, 165) explained, "... people generalize from job experience, not only to their psychological functioning off the job, but to the actual activities they perform in their leisure time."

However, we strongly believe that the findings of the Kohn and Schooler research tradition are central to understanding *processes* of enhancing or losing literacy in the workplace. These studies have pushed the "occupational socialization" perspective in a direction that merges with literacy research. Their theorizing about the psychological effects of complex work environments is a general variant of the "use it or lose it" argument we have been proposing in this report. In other words, for workers with moderate or high levels of literacy, the cumulative effect of working in a non-complex job could be loss of skills. For workers with low literacy levels, an unchallenging work environment increases the odds that they will not actively engage in developing their literacy on or off the job.

Further evidence indirectly supporting the "use it or lose it" hypothesis

We conclude our literature review by introducing four additional strands of evidence that provide indirect support for the argument that work environments may either stifle or nurture literacy skills. The first, from experimental psychology, was introduced by Schooler (1984) to help generalize her theoretical propositions. Suedfeld's (1975) review of sensory deprivation research concluded that, for low-complexity tasks (e.g., memorizing a list of words; recalling previously learned material), sensory deprivation may actually lead to enhanced performance. In contrast, sensory deprivation can lead to reduced performance on a high-complexity task "that could be solved in many ways, [is] relatively unstructured and novel, and [calls] for creativity, imagination, and synthesis of ideas" (Suedfeld 1975, 64). Despite the fact that these studies did not focus directly on literacy, they do suggest that workers deprived of the opportunity to perform complex literacy-based tasks may lose some literacy proficiency.

A second type of evidence comes from experimental research on learning and memory throughout the life-course. This research tradition has compared samples of younger and older subjects on memory tasks conducted in a laboratory setting (Perlmutter 1983; Salthouse 1988). Findings suggest that older adults typically perform less well, but that age differences are small. Furthermore, some older adults do better than some younger adults. Thus, at least up to age 60 or 70, age is not a particularly good predictor of cognitive performance (Perlmutter 1983, 231). Schooler (1984, 268–70) argued that the presumed age-related decline in intellectual functioning may partly reflect the fact that older people have less complex, demanding work environments (*see also* Miller, Slomczynski and Kohn 1985). According to Perlmutter (1983, 235), while a reduced cognitive capacity among the elderly might be an explanation, equally possible is the "disuse" hypothesis. That is, "formerly acquired cognitive strategies become functionally less available" with disuse.

This "disuse" hypothesis is the converse of learning theory's position that "practice makes perfect." However, because of methodological limitations there have been few published tests of the disuse hypothesis. It is relatively easy to design experimental tasks that involve learning new skills. However, it is more difficult to set up experiments to monitor the effects of skill disuse. The time required for skills to atrophy would, no doubt, extend beyond the possibilities offered by laboratory settings.

A third and related type of evidence comes from developmental psychology, specifically action theory applied to skill-learning. In an argument reminiscent of Schooler's "complex environment" theory, Frese and Stewart (1984, 153) suggested that "impaired functioning is the result of fewer intellectual demands being placed on the individual by the environment." They concluded that higher-order skills may be lost:

> If one has not ridden on a bicycle for about 10 years there will be relatively little difficulty when one attempts to ride a bicycle again. However, a task which has been mastered at a higher level of regulation will show much more dramatic results of disuse, for example, doing calculus problems or playing a strategic game of tennis after many years of disuse. (Frese and Stewart 1984, 153).

A final research tradition combines themes from the occupational socialization perspective and the psychological theories noted above. Reviewing extensive research on the effect of different types of work environments on workers' health and well-being, Karasek and Theorell (1990) proposed a theory of "active learning" to explain variations in job stress. They began by hypothesizing that work is less stressful if workers have more decision-making control over their job demands and then introduced the concept of "environmental learning":

> In our model, learning occurs in situations that require both individual psychological energy expenditure (demands or challenges) and the exercise of decision-making capability. As the individual with decision-making latitude chooses how best to cope with a new stressor, that new behaviour response, if effective, will be incorporated into his or her repertoire of coping strategies; that is, it will be learned. The expanded range of solutions to environmental challenges raises the person's potential activity level in the future. (Karasek and Theorell 1990, 92).

This view of environmental learning is directly relevant to our discussion. This perspective posits a complex interplay between the skills and attributes workers bring to a job, the psychological demands of that job and workers' decision-making control that may or may not allow them to respond to these demands. This same web of factors can, we believe, also influence the development and use of literacy skills. Furthermore, it is clear how learning of literacy and other skills can best be encouraged—by redesigning jobs to make them more cognitively challenging.

Equally crucial for our argument is the opposite situation, that of a job with limited psychological demands and little decision-making control. As Karasek and Theorell (1990, 94) explained: "This passive situation, which unfortunately appears to be present in many jobs ... could be associated with the reverse process of skill atrophy and unlearning." They cited the growing literature on "learned helplessness"—essentially "unlearning"—to buttress this interpretation of skill atrophy (e.g., Van Maanen and Schein 1979; Denney 1982; Lennerlöf 1991). Although much literature on the work environment focuses on the negative effects of stressful working conditions, again there are close parallels with points raised in our discussion of literacy research. Specifically, this line of research and its theoretical underpinnings are consistent with our proposition that workers might lose (or "unlearn") some of their literacy skills if they do not have enough opportunities to use them.

Chapter 2

Research findings

Summing up our arguments to this point, when the subject of workplace literacy is situated within a broader agenda of human resource development we are reminded to focus not only on workers with literacy deficits but also on those with well-developed literacy skills. The latter could include workers who might be described as having a literacy surplus—their literacy skills might significantly exceed the skill-demands of their job. Research findings from various social science disciplines are remarkably consistent in concluding that higher-order learned skills may atrophy when not used regularly. Although none of this research has focused directly on literacy skills, it seems reasonable to hypothesize that, when used infrequently in the workplace, literacy skills also might decline.

Thus, we turn to our analysis of the Canadian IALS data (*see* Appendix A for details on the IALS research design and measurement strategy).[6] We focus first on the degree of fit or mismatch between Canadian workers' literacy skills and their job requirements, and then on a test of the "use it or lose it" hypothesis with respect to literacy skills.

Levels of literacy

We begin our analysis by profiling the literacy levels (prose, document and quantitative) of the Canadian *population* 16 years of age and older, and then compare these distributions with the literacy level of the *employed* population. Table 2.1 presents proportions in each of four literacy levels (Levels 4 and 5 are combined because relatively few individuals scored at the highest level). The means and standard deviations for each of the original literacy scales (measured on a possible range of 0 to 500) from which the literacy level data were derived are also included in Table 2.1.

Table 2.1 **Levels of prose, document and quantitative literacy, Canadian adults aged 16 and over and employed population, 1994**

	Total adult population			Employed population		
Literacy level	Prose	Document	Quantitative	Prose	Document	Quantitative
		%			%	
Level 1	21	23	22	12	12	12
Level 2	26	24	26	25	24	25
Level 3	33	30	32	37	35	36
Level 4/5	20	22	20	26	29	27
Mean	270	269	272	287	291	292
Std. Dev.	68	76	68	62	66	61

Numbers may not add due to rounding.

Not surprisingly, the employed population displays a higher level of literacy than the total adult population because, on average, the former would be younger and more educated (these patterns are explored further in Tables 2.3 and 2.4). Specifically, for each of the three dimensions of literacy assessed in the IALS, there is a lower proportion of the employed in Level 1 and a higher proportion in Level 4/5 (*see* Table 2.1). For example, focusing on document literacy, 23% of the total adult population are in Level 1, compared with only 12% of the employed population. In contrast, 29% of the employed are in Level 4/5 compared to only 22% of the total population. Thus, although the cut-off points on the original (0 to 500) literacy scales left roughly similar proportions of the population in each level, the employed population reveals a literacy distribution with more than twice as many individuals in the highest levels than in the lowest levels.

By international standards, Canadian workers have relatively high levels of prose, document and quantitative literacy. For example, based on comparisons with the employed population in the six other nations that participated in the IALS, Canada is second only to Sweden in the proportion of the employed in Level 4/5 on all three dimensions (OECD/Statistics Canada 1995, 127–129). These cross-national differences probably reflect, to some extent, the higher proportion of Canadian youth who go on to postsecondary education (Oderkirk 1993). They also suggest that, in terms of human capital stocks, Canadian employers have an advantage over their competitors in other industrialized countries. However, as we have already argued, such an advantage assumes that most Canadian workers are employed in jobs that take advantage of their literacy skills.

Average literacy scores

To examine gender, age and education differences more efficiently, Tables 2.2, 2.3 and 2.4 move away from the literacy levels and, instead, present average scores (and standard deviations) on the original literacy scales. Although the differences are small, men score higher on document and quantitative literacy in the total adult population, whereas women score higher on prose literacy (*see* Table 2.2). In contrast, in the employed population, women have somewhat higher average scores than men on all three literacy dimensions, with the largest average difference (17 points higher) for prose literacy.[7]

Table 2.2 **Prose, document and quantitative literacy scores by gender, Canadian adults aged 16 and over and employed population, 1994**

	Total adult population		Employed population	
Literacy score	Mean	Standard deviation	Mean	Standard deviation
Prose literacy				
Total	**270**	**68**	**287**	**62**
Females	275	65	297	58
Males	265	70	280	64
Document literacy				
Total	**269**	**76**	**291**	**66**
Females	267	76	293	60
Males	271	74	290	71
Quantitative literacy				
Total	**272**	**68**	**292**	**61**
Females	270	66	294	58
Males	275	70	291	64

On average, younger Canadians score higher on each of the three literacy scales. The age differences (*see* Table 2.3) are considerably larger than the gender differences already noted (*see* Table 2.2). These age differences are, in large part, the result of the higher educational attainment of younger cohorts, but they could also reflect some literacy loss among older Canadians, if the "use it or lose it" hypothesis has any merit (Willms, 1997b). The differences between the oldest and youngest cohorts are much smaller in the employed adult population. For example, the average prose literacy score for all Canadians 66 years of age and older is 216, compared with an average score of about 285 for the two youngest cohorts. In contrast, the average prose score for employed seniors is 265, only about 25 points lower than the average for the two youngest employed cohorts. More literate Canadians are, no doubt, more successful in the labour market and so we might see more of them continuing to be employed after age 65. Alternatively, perhaps continued participation in the labour force allows individuals to maintain their literacy skills, dependent on other relevant factors.

Table 2.3 **Prose, document and quantitative literacy scores by age, Canadian adults aged 16 and over and employed population, 1994**

	Total adult population		Employed population	
Literacy score	Mean	Standard deviation	Mean	Standard deviation
Prose literacy				
Total	**270**	**68**	**287**	**62**
16–25	286	52	288	54
26–35	285	63	292	61
36–45	290	65	300	58
46–55	269	62	279	63
56–65	236	71	241	75
66 and older	216	65	265	44
Document literacy				
Total	**269**	**76**	**291**	**66**
16–25	294	63	297	65
26–35	291	68	303	63
36–45	289	66	298	60
46–55	266	65	279	63
56–65	224	82	233	84
66 and older	207	72	269	52
Quantitative literacy				
Total	**272**	**68**	**292**	**61**
16–25	284	54	284	58
26–35	290	64	301	60
36–45	297	66	308	58
46–55	267	59	280	57
56–65	240	66	248	70
66 and older	218	64	270	47

As already noted, literacy is strongly influenced by education (*see* Table 2.4). Because education and employment are also correlated, differences in average literacy scores between the total population and the employed population, within each education level, are typically not large. Focusing then on the employed population, we observe that individuals with 17 or more years of education–which for most would mean one or more university degrees—have substantially higher average scores on each of the three literacy dimensions.

Table 2.4 **Prose, document and quantitative literacy scores by educational attainment, Canadian adults aged 16 and over and employed population, 1994**

	Total adult population		Employed population	
Literacy score	Mean	Standard deviation	Mean	Standard deviation
Prose literacy				
Total	**270**	**68**	**287**	**62**
1–11 years	226	68	239	71
12 years	282	49	285	45
13–16 years	300	47	303	45
17 or more years	326	41	333	40
Document literacy				
Total	**269**	**76**	**291**	**66**
1–11 years	218	74	237	72
12 years	285	53	292	49
13–16 years	307	52	313	50
17 or more years	326	51	332	50
Quantitative literacy				
Total	**272**	**68**	**292**	**61**
1–11 years	226	64	242	62
12 years	284	47	290	43
13–16 years	301	48	306	47
17 or more years	337	49	348	46

The average gap between the most highly educated and those in the next level (13 to 16 years of formal education) is large (about 20 points for document, 30 for prose, and 40 for quantitative literacy). This difference is exceeded by the gap between those who have only completed high school (12 years) and those with even less formal education. Within the employed population, individuals with 11 or fewer years of education score about 50 points below high school graduates. It is important to remember, however, that the lowest education level contains both very young IALS respondents (many still in school) as well as some of the oldest respondents who, on average, received less formal education. Even so, literacy deficits and lack of formal education appear to go hand in hand.

Workplace literacy requirements

To this point, we have discussed only literacy abilities, as measured in the IALS. From our perspective, it is equally important to examine literacy use. To what extent do Canadian workers use their prose, document and quantitative literacy skills on the job? We answer this question by examining IALS respondents' self-reports of how often they performed specific reading, writing and mathematical tasks in their (main) job. Using a frequency scale with responses ranging from "every day" to "rarely or never," the IALS measured workplace literacy requirements for five reading, four writing and two mathematical activities (*see* Table 2.5).

Table 2.5 Frequency of performing specific workplace reading, writing and numeracy tasks, employed population, Canada, 1994

Task	Frequency of performing task				
	Every day	A few times weekly	Once a week	Less than once a week	Rarely or never
			%		
Read or use information from					
• letters, memos	52	15	7	6	20
• reports, articles, magazines, journals	35	16	8	12	29
• bills, invoices, spreadsheets, budget tables	34	9	7	12	38
• manuals, reference books, catalogues	30	13	10	16	32
• diagrams, schematics	19	9	6	14	52
Write or fill out					
• letters, memos	35	14	9	10	32
• forms, bills, invoices, budgets	30	11	9	10	40
• reports, articles	25	10	7	14	44
• estimates, technical specifications	13	10	6	10	62
Use mathematics to					
• measure, estimate the size or weight of objects	37	8	3	11	41
• calculate prices, costs, budgets	35	9	6	13	37

Numbers may not add due to rounding.

Clearly, reading memos and letters is, by far, the most frequent literacy-based task required of employed Canadians—more than half (52%) report that they do so daily. Just over one-third read or use information from reports, articles, magazines and journals daily; a similar proportion work daily with bills, invoices and spreadsheets or budget tables. Almost as many (30%) consult manuals or reference books (including catalogues), whereas only one in five (19%) work daily with diagrams or schematics.

As indicated by the IALS, writing tasks are required somewhat less frequently than reading tasks in Canadian workplaces (*see* Table 2.5). Just over one-third of the employed (35%) write letters or memos daily, and 30% fill out forms, bills, invoices or budgets. One-quarter write reports or articles daily, whereas 13% produce estimates or technical specifications. Turning to mathematics-based tasks, measuring or estimating the size or weight of objects is the more common requirement, performed daily by 37% of employed Canadians. Almost as many (35%) calculate prices, costs or budgets daily.

It is equally useful to examine the proportion of employed Canadians who rarely or never perform these specific tasks in their main job (*see* Table 2.5). These findings are indeed striking: one in five workers rarely or never read letters or memos, about one-third rarely or never write letters or memos, and almost two out of five answered "rarely or never" in response to the question about calculating prices, costs, or budgets. These are basic activities; other literacy tasks are even less likely to be required.

Variations in workplace literacy requirements

To reduce the many measures of workplace literacy activity to a more manageable number and, at the same time, to create more reliable measures, four multi-item indices of workplace literacy requirements were constructed using the data displayed in Table 2.5. The indices—reading, writing, reading and writing combined and quantitative literacy requirements—are each measured on a scale of 1 to 5, as were the original IALS questions from which they are constructed (*see* Box 1 for additional information on construction of the indices).

Box 1

Workplace literacy requirement indices

The IALS interview included seven questions asking respondents how often they read or used information from different kinds of documents in their main job, four questions about how often they write or fill out different kinds of documents (such as forms) and two questions about how often they use mathematics. Possible responses for each question ranged from "every day" to "rarely or never." Examining zero-order correlations among responses to the 13 questions showed that, although most of the coefficients were at least of moderate strength, the correlations within the sets of reading, writing and numeracy measures were generally stronger than the correlations between measures in the different sets, suggesting that it would be appropriate to construct three separate indices. However, two of the seven questions in the "reading requirements" sequence (reading "material written in a language other than English" and reading "directions or instructions for medicines, recipes, and other products") were not as highly correlated with the other reading measures and so were dropped.

For each of the remaining 11 items, responses were recoded so that an answer of "rarely or never" received a score of 1, whereas the answer "every day" was scored as 5. The recoded responses to the five reading items, four writing questions and two numeracy measures were then averaged to create a Reading Index, a Writing Index, and a Quantitative Index, respectively.

The reliability of each of the three indices was evaluated by calculating Cronbach's Alpha, a correlation-based statistic that can range from 0 to 1.0, with higher values signifying more reliable indices (an Alpha of .70 is generally considered acceptable). Alpha for the five-item Reading Index is 0.77. The reliability of the four-item Writing Index is almost as high (Alpha = 0.73). Because Alpha increases both with the size of the correlations among items used to construct an index, and with the number of items used, not surprisingly the calculated reliability of the Quantitative Index is only 0.46 (based on a correlation of 0.30 between the two items).

Further analyses revealed moderate to strong relationships between the three indices, with correlations of 0.77 between the Reading and Writing Indices, and 0.50 between each of these and the Quantitative Index. Thus, jobs with high literacy requirements of one kind also tend to have similar requirements on the other two dimensions of literacy. However, because the pattern of reading and writing requirements is somewhat more consistent ($r = 0.77$), a fourth Combined Reading–Writing Index that simply averaged the two component indices was also constructed. By averaging the two indices (one with four items and the other with five) rather than constructing a new nine-item index, reading and writing were given equal weight in the combined index.

As shown in Table 2.6, average scores on these workplace literacy requirement indices vary considerably by industry and occupation (*see* Box 2 for an overview of the industry and occupational classification systems). Beginning with industry differences, we note that Canadians employed in the primary industries and in construction report the lowest reading and writing requirements in their jobs. For reading requirements, manufacturing and business and personal services also reveal below-average index scores whereas, for writing requirements, community service industries join construction, manufacturing and the primary industries in the below-average category. Trade (retail and wholesale combined) hovers around the index averages for both reading and writing requirements. In contrast, finance has the highest average scores on the reading and writing indices, followed by public administration, and then transportation, communication and utilities.

Box 2

Industry, occupation and employment status classifications

A nine-category industry typology (see Table 2.6) based on the 1980 Standard Industrial Classification system is used in this report. Agriculture, mining, fishing and trapping and forestry are classified as primary industries. Both wholesale and retail trade are included in the trade category. Finance includes real estate and insurance industries, along with banking. Community services incorporate education, health and recreational services. Business and personal services include both business management services as well as food, accommodation and entertainment services. Federal, provincial and municipal government employees make up the public administration industry.

To maintain comparability with previous IALS reports, we use an eight-category occupational classification system based on the 1988 International Standard Classification of Occupations. Managers at all levels and in all industries make up the first category; professionals in all fields (e.g., nurses, engineers, scientists and lawyers) are grouped in the second. The technician and semi-professional category includes skilled technical workers and associate professionals (e.g., teaching and health assistants) in a wide range of employment settings. Clerical workers include both office and retail clerks; most service workers are employed in the accommodation, food and beverage and protective services. A small number of skilled agriculture and fishery workers have been included in the skilled craft worker grouping. Machine operators include factory workers as well as drivers in various industries. Finally, unskilled workers in both the service and goods-producing sectors are included in the elementary occupations category.

All respondents were also grouped into one of five employment status categories (see Table 2.7): employees with no supervisory responsibility (including unpaid family workers); those with limited supervisory responsibility (up to five other people); those with extensive responsibility (more than five persons); employers without employees (the self-employed without employees); and employers with employees (self-employed with employees).

Table 2.6 Average scores on four workplace literacy requirement indices, by occupation and industry, Canada, 1994

Industry and occupation	Reading index[1] (scale range 1–5)[2]	Writing index[3] (scale range 1–5)	Combined reading–writing index[4] (scale range 1–5)	Quantitative index[5] (scale range 1–5)
All employed	**3.01**	**2.62**	**2.82**	**2.91**
Industry				
Primary	2.41	1.95	2.18	2.88
Manufacturing	2.81	2.50	2.66	2.94
Construction	2.43	2.13	2.31	3.48
Transportation, communication, utilities	3.20	3.00	3.10	3.31
Trade	3.01	2.66	2.84	3.36
Finance	3.82	3.57	3.70	3.21
Community services	3.17	2.44	2.81	2.32
Business, personal services	2.78	2.71	2.75	2.93
Public administration	3.44	3.00	3.23	2.74
Occupation				
Managers	4.01	3.56	3.79	3.67
Professionals	3.79	3.20	3.49	2.95
Technicians, semi-professionals	3.12	2.39	2.75	2.48
Clerical workers	2.91	2.72	2.82	2.88
Service workers	2.55	2.34	2.44	2.93
Skilled craft workers	2.53	2.16	2.35	3.06
Machine operators	2.50	2.30	2.40	2.66
Elementary occupations	2.28	2.04	2.17	2.78

1. The Reading index is an average of scores for the five reading activity measures in Table 2.5; Cronbach's Alpha for this five-item index is 0.77.
2. All indices reported in this table use a 1–5 scale (rarely or never; less than once a week; once a week; a few times weekly; every day), with 5 indicating daily use of literacy skills.
3. The Writing index is an average of scores for the four writing activity measures in Table 2.5; Cronbach's Alpha for this four-item index is 0.73.
4. The Combined reading–writing index is an average of the Reading index and Writing index scores.
5. The Quantitative index is an average of scores for the two mathematical activity measures in Table 2.5; the correlation between these two items is 0.30.

For the quantitative requirements index, a somewhat different pattern emerges. Community services have the lowest average score, followed by public administration, then business and personal services. Construction and trade have the highest scores. These findings are to be expected, given that the quantitative index consists of two items that focus on activities commonly found in construction (measuring and estimating sizes and weights) and trade (calculating prices and costs). These across-industry differences help explain why the workplace quantitative requirements index is only moderately correlated with the reading and the writing indices (*see* Box 1). It appears that, to some extent, a sizable proportion of Canadian jobs require reading and writing skills, or mathematical skills, but not both. Only two industrial sectors—finance, and transportation, communication and utilities—combine high levels of all three literacy activities.

Because industrial categories encompass many different kinds of jobs, it is also useful to examine workplace literacy requirements by occupation. Occupations, simply defined, are clusters of tasks performed in a job. As we might expect, managers and professionals report above-average reading and writing requirements (*see* Table 2.6). With the exception of technicians and semi-professionals, all other occupational groups fall below the average on the reading index. For the writing requirements index, clerical workers join managers and professionals in the above-average grouping. Even "skilled" craft workers—in the upper levels of manual occupations, and where employers often claim skill shortages—have a combined reading–writing requirements index score well below the average for the total employed population.

Again, the quantitative index reveals a different pattern (*see* Table 2.6). Although managers still score the highest, on average, skilled craft workers come next in line (so, perhaps, when speaking about skill shortages, employers are referring more to a need for quantitatively adept workers in craft occupations). Also, professionals and service workers have above-average quantitative literacy requirements, whereas the remaining occupations score below average in this regard.

It is also evident that literacy requirements depend, at least in part, on some other aspects of one's employment status. Thus, workers with no supervisory responsibility score well below average on all the workplace literacy requirement indices, whereas the opposite is true for those with extensive supervisory responsibility (*see* Table 2.7). Focusing only on the self-employed, the self-employed without employees report below-average reading and writing requirements in their jobs, although they are above average on the quantitative index. In comparison, self-employed with employees appear to be similar to those employees with extensive supervisory responsibility in terms of reading and writing requirements, and well above this group on the quantitative index.

Table 2.7 Average scores on four workplace literacy requirement indices, by selected employment status indicators, Canada, 1994

Employment status	Reading index[1] (scale range 1–5)[2]	Writing index[3] (scale range 1–5)	Combined reading–writing index[4] (scale range 1–5)	Quantitative index[5] (scale range 1–5)
All employed	**3.01**	**2.62**	**2.82**	**2.91**
Employees' supervisory responsibility				
None	2.61	2.21	2.42	2.45
Limited	3.44	3.10	3.27	3.36
Extensive	4.06	3.53	3.81	3.61
Self-employed				
No employees	2.84	2.60	2.72	3.34
With employees	3.86	3.48	3.68	4.29
Full-time job	3.10	2.70	2.90	2.96
Part-time job	2.55	2.24	2.40	2.64
Permanent job	3.10	2.68	2.89	2.94
Temporary job	2.27	2.13	2.21	2.67
Firm size <20	2.88	2.60	2.75	3.40
Firm size 20–99	2.67	2.49	2.59	2.53
Firm size 100–199	2.79	2.07	2.43	2.37
Firm size 200–499	3.10	2.86	2.98	2.71
Firm size ³ 500	3.28	2.80	3.04	2.89

1. The Reading index is an average of scores for the five reading activity measures in Table 2.5; Cronbach's Alpha for this five-item index is 0.77.
2. All indices reported in this table use a 1–5 scale (rarely or never; less than once a week; once a week; a few times weekly; every day), with 5 indicating daily use of literacy skills.
3. The Writing index is an average of scores for the four writing activity measures in Table 2.5; Cronbach's Alpha for this four-item index is 0.73.
4. The Combined reading–writing index is an average of the Reading index and Writing index scores.
5. The Quantitative index is an average of scores for the two mathematical activity measures in Table 2.5; the correlation between these two items is 0.30.

On all the on-the-job literacy requirement indices, workers in full-time or permanent jobs score considerably higher than part-time or temporary workers. Firm size displays a U-shaped relationship with the four indices although, for the reading and writing indices, workers in the largest firms report more frequent literacy requirements in their jobs than do those in the smallest

firms. Although the IALS data do not permit further analysis of this finding (because of sample size restrictions), we can speculate that the consistently low scores reported by workers in firms with 100 to 199 employees probably reflect these firms' industry location, occupational mix and work force educational levels.[8]

Literacy "fit" and "mismatch" in the workplace

The first of our two main research goals is to document the extent to which employed Canadians use their literacy skills in their jobs. At issue is the "fit" or the "mismatch" between an individual's literacy skills, on one hand, and, on the other, how much her or his job makes use of these different forms of human capital. Because, in any given period, some workers change jobs and some jobs change in their skill requirements, it is difficult to define what we might consider the optimal use of a society's human capital (in this study indexed by literacy skills). Even so, a better fit would be preferred over a poor fit. Ideally, public policy coupled with market incentives would induce employers to increase workplace literacy requirements (i.e., to create more knowledge-based jobs), just as employees with lower literacy skills would be encouraged to upgrade through further education and training.

Our method of measuring literacy "fit" or "mismatch" is described in detail in Box 3. In brief, we collapsed the two key indices for workplace literacy—reading–writing combined and numeracy—into three four-level measures resembling those introduced earlier for individuals' own literacy proficiency; the four-level prose, document and quantitative literacy measures (*see* Table 2.1). Then the relevant individual literacy skill and workplace requirement measures were cross-tabulated to produce three four-by-four tables. These displays of prose (*see* Table 2.8), document (*see* Table 2.9) and quantitative (*see* Table 2.10) literacy "fit" and "mismatch" indicate the extent to which the literacy skills of Canadian workers appear to be used in Canadian workplaces.

For each literacy dimension examined in the IALS, five combinations are possible, given the way we have constructed the two measures:

- low literacy skills and low literacy requirements in the workplace
- medium literacy skills and medium literacy requirements
- high literacy skills and high literacy requirements
- low literacy skills and high literacy requirements (a *literacy deficit*)
- high literacy skills and low literacy requirements (a *literacy surplus*)

Workers whose literacy skills roughly "fit" their job requirements (low–low, medium–medium and high–high) appear in the diagonal section (top left to bottom right) of each of Tables 2.8, 2.9 and 2.10. To simplify our discussion of the subsequent analyses, we label workers whose literacy scores are two or more levels *below* the literacy requirements of their job as exhibiting a *literacy deficit* (the top right section of each table). Conversely, workers whose literacy scores are two or more levels *above* the literacy requirements of their job are considered to have a *literacy surplus* (the lower left section of each table). Some readers may prefer to label the latter as being "under-employed," at least with respect to literacy skills, recognizing that these are not the only skills required in workplaces.

Box 3

Constructing measures of literacy "fit" and "mismatch" in the workplace

Box 1 described the construction of four "workplace literacy requirements" indices (see Table 2.6). Two of these indices, the Combined Reading–Writing Index and the Quantitative Index are used to construct measures of the "fit" or "mismatch" between workers' literacy skills and their job requirements. Both indices ranged in value from 1.0 to 5.0, because they were created by averaging the 1 to 5 responses to the original questions. The many possible different values on each index were then collapsed into four categories (1.0 to 1.99 = 1; 2.0 to 2.99 = 2; 3.0 to 3.99 =3; 4.0 to 5.0 = 4) that basically reflected the range of original response categories ("rarely–never" to "every day"; see Table 2.5), with higher values indicating more frequent reading–writing or mathematical requirements.

These four-category "workplace literacy requirement" measures were then cross-tabulated by the literacy (also four levels; see Table 2.1) of employed sample members. Specifically, the distributions of prose literacy and document literacy were cross-tabulated by the Reading–Writing requirements measure (Tables 2.8 and 2.9, respectively), whereas quantitative literacy was cross-tabulated by the Quantitative requirements measure (Table 2.10). In each case, the resulting table displays the number of employed Canadians whose literacy skills more or less "fit" the requirements of their job (the top left to lower right diagonal of the table). Tables 2.8, 2.9 and 2.10 also indicate the number of employed Canadians who are "mismatched," including those we would characterize as exhibiting a ***literacy deficit*** *(the upper right corner of the table) and those showing a* ***literacy surplus*** *(the lower left corner of the table). The latter might also be described as being "under-employed" in terms of their literacy skills.*

Although the operational definitions of literacy deficit and literacy surplus are necessarily somewhat arbitrary, we include in the former category those employed individuals whose measured literacy ability is at least two categories below the literacy requirement of their job. In contrast, we place individuals whose measured literacy ability is at least two categories above the literacy requirement of their job into the literacy surplus category. Thus, by definition, only individuals in the top two literacy groups could be included in the literacy surplus category and only those in the bottom two literacy groups could be included in the literacy deficit category.

Table 2.8 **Prose literacy "fit–mismatch" in the workplace, employed population, Canada, 1994**

	Workplace reading–writing requirements % (population estimates in '000s)				
Prose literacy level	**1 (low)**	**2**	**3**	**4/5 (high)**	**Total**
1 (low)	64 (839)	17 (221)	12 (162)	7 (85)	100 (1,307)
2	34 (993)	31 (924)	19 (572)	16 (469)	100 (2,958)
3	21 (931)	26 (1,150)	29 (1,279)	24 (1,039)	100 (4,399)
4/5 (high)	10 (304)	41 (1,283)	30 (917)	19 (598)	100 (3,102)
Column pop. est.	(3,067)	(3,578)	(2,930)	(2,191)	(11,766)

Key to shading

Low prose literacy skills and low reading–writing requirements

Medium prose literacy skills and medium reading–writing requirements

High prose literacy skills and high reading–writing requirements

Low prose literacy skills and high reading–writing requirements (literacy deficit)

High prose literacy skills and low reading–writing requirements (literacy surplus)

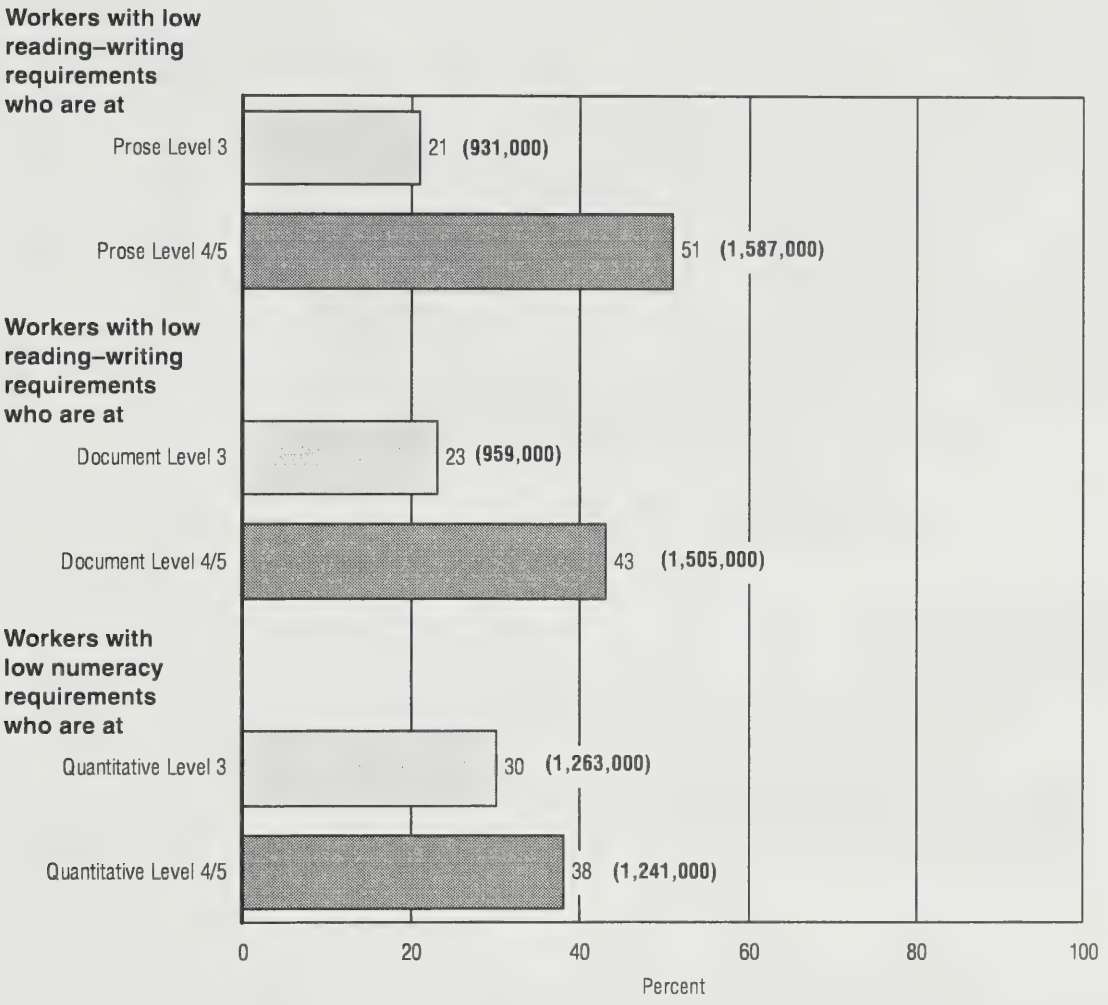
"Fit" between workers' skills and job requirements.

"Mismatch" between workers' skills and job requirements.

Looking first at prose literacy and reading–writing requirements (*see* Table 2.8), we observe a sizable proportion of Canadian workers with low literacy skills who are in jobs that present them with few literacy requirements (about 2 million in total). We find larger numbers (close to 4 million) with medium-level literacy skills employed in jobs with mid-range literacy requirements. Indeed, half of all workers with Level 2 prose literacy are in such an employment situation, as are 55% of those in the next highest level. Continuing our examination of the "fit" between literacy skills and job requirements, we see about 2.5 million Canadians with high literacy skills in jobs requiring a high degree of prose literacy.

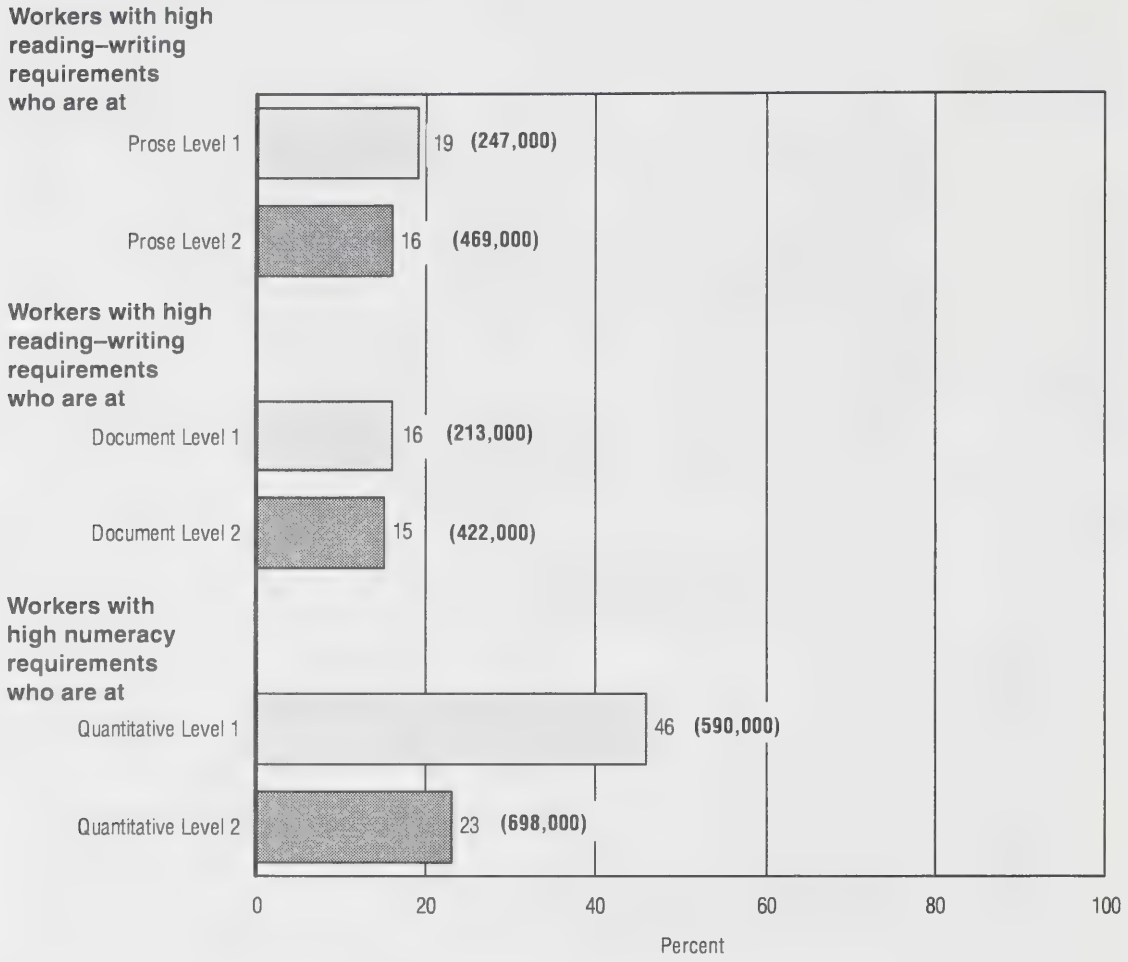
Table 2.8 also reveals 21% of those with Level 3 prose skills in jobs with low workplace reading–writing requirements (*see* Figure 2.1). Of even greater concern is the finding that fully half of those in the highest prose literacy category (Level 4/5) are in the literacy surplus category. Thus, in absolute numbers, we observe about 2.5 million Canadians whose jobs do not appear to take full advantage of their prose literacy skills. Literacy deficits reflect the other possible form of literacy "mismatch." However, with respect to prose literacy, this problem is not as widespread. In total, about 700,000 workers are in jobs with prose literacy demands that appear to exceed their skills,[9] including 19% of those at Level 1 on prose literacy and 16% of those at Level 2 (*see* Table 2.8 and Figure 2.2).

Figure 2.1 **Proportion of workers with high literacy skills reporting low literacy requirements on the job[1]**



1. Percentage of workers at Levels 3 and 4/5 of four-level literacy scales (prose, document and quantitative) whose job literacy requirements (reading–writing or numeracy) are two levels lower (*see* lower left of Tables 2.8, 2.9 and 2.10).

Figure 2.2 **Proportion of workers with low literacy skills reporting high literacy requirements on the job[1]**



1. Percentage of workers at Levels 1 and 2 of four-level literacy scales (prose, document and quantitative) whose job literacy requirements (reading–writing or numeracy) are two levels higher (*see* upper right of Tables 2.8, 2.9 and 2.10).

Turning to document literacy (*see* Table 2.9), we note similar patterns of "fit" and "mismatch," not surprisingly, given that the same measure of workplace reading–writing requirements was used in both analyses. For example, 54% of employed Canadians workers at Level 2 on document literacy and 58% at Level 3 are in jobs with medium literacy requirements, representing a total of almost 4 million in the medium–medium "fit" category. The low–low "fit" group contains about 2 million employed Canadians and, like the pattern for prose literacy, a somewhat larger proportion are located in the high–high "fit" category (almost 2.8 million individuals).

Table 2.9 **Document literacy "fit–mismatch" in the workplace, employed population, Canada, 1994**

	Workplace reading–writing requirements % (population estimates in '000s)				
Document literacy level	**1 (low)**	**2**	**3**	**4/5 (high)**	**Total**
1 (low)	62 (846)	22 (293)	8 (111)	8 (102)	100 (1,352)
2	31 (872)	31 (869)	23 (657)	15 (422)	100 (2,820)
3	23 (959)	32 (1,302)	26 (1,067)	19 (782)	100 (4,110)
4/5 (high)	11 (390)	32 (1,115)	32 (1,095)	25 (885)	100 (3,485)
Column pop. est.	(3,067)	(3,579)	(2,930)	(2,191)	(11,767)

Key to shading

Low document literacy skills and low reading–writing requirements

Medium document literacy skills and medium reading–writing requirements

High document literacy skills and high reading–writing requirements

Low document literacy skills and high reading–writing requirements(literacy deficit)

High document literacy skills and low reading–writing requirements (literacy surplus)

"Fit" between workers' skills and job requirements.

"Mismatch" between workers' skills and job requirements.

Regarding document literacy surplus, 23% of employed Canadians in Level 3 and 43% in Level 4/5 occupy jobs with low literacy requirements (*see* Table 2.9 and Figure 2.1). Combined, this adds to about 2.5 million individuals in jobs that do not seem to require their level of skill, a total similar to that observed for prose literacy. The pattern of document literacy deficit also parallels the prose pattern, with around 15% in each of Levels 1 and 2 holding jobs that require literacy skills two or more levels higher (more than 600,000 in total).

To this point, our analyses have shown that patterns of quantitative literacy and workplace numeracy requirements differ somewhat from those for either prose or document literacy and reading or writing requirements on the job. Again, this finding is apparent in Table 2.10. The low skill–low requirement group is somewhat smaller (about 1.7 million), as is the medium–medium group. The latter includes 43% of the employed with Level 2 numeracy skills and 35% of those in Level 3 (about 2.8 million people in total). In turn, the group in the skill surplus category is proportionally larger for those in Level 3 (30%), but somewhat smaller for Level 4/5 (38%; *see* Figure 2.1). Still, the absolute size of the skill surplus group is similar, at around 2.5 million. In contrast, the group defined as having skill deficits (about 1.3 million; *see* Figure 2.2) and those in the high skill–high requirement "fit" category (almost 3.5 million) represent larger proportions of the total employed labour force.

Table 2.10 Quantitative literacy "fit–mismatch" in the workplace, employed population, Canada, 1994

	Workplace numeracy requirements % (population estimates in '000s)				
Quantitative literacy level	**1 (low)**	**2**	**3**	**4/5 (high)**	**Total**
1 (low)	44 (571)	10 (130)	31 (394)	15 (196)	100 (1,291)
2	34 (1,020)	10 (284)	33 (990)	23 (698)	100 (2,992)
3	30 (1,263)	8 (328)	27 (1,185)	35 (1,501)	100 (4,277)
4/5 (high)	16 (520)	22 (721)	28 (904)	34 (1,092)	100 (3,237)
Column pop. est.	(3,374)	(1,463)	(3,473)	(3,487)	(11,797)

Key to shading

Low quantitative literacy skills and low numeracy requirements

Medium quantitative literacy skills and medium numeracy requirements

High quantitative literacy skills and high numeracy requirements

Low quantitative literacy skills and high numeracy requirements (literacy deficit)

High quantitative literacy skills and low numeracy requirements (literacy surplus)

"Fit" between workers' skills and job requirements.

"Mismatch" between workers' skills and job requirements.

Generalizing across these three separate analyses of worker–job literacy "fit" and "mismatch" (i.e., for prose, document and quantitative literacy), it is apparent that the proportions of Canadians employed in medium–medium or high–high "fit" situation is always larger than the proportion in low–low "fit" settings (note that the "total" rows in Table 2.11 present a quick comparison). In fact, for quantitative literacy, the high–high category is the largest of the three. Assuming that a high-skill economy (referring both to workers and their jobs) is preferable over lower-skill alternatives, these are encouraging results, even though larger proportions in the high–high category should be our goal.

But the finding that more than one in five employed Canadians are working in jobs that do not appear to fully make use of their literacy skills is troubling, particularly because public discussions of the "skills gap" in the Canadian labour force frequently imply that the problem is one of a shortage of skilled workers, not skilled jobs.[10] The 5% to 11% placed in the skill deficit category are also cause for concern, but for different reasons (i.e., are they capable of performing their jobs adequately?). Even if we were to calculate our measures of "fit" and "mismatch" in different ways, thus raising or lowering the proportions in the literacy surplus and literacy deficit categories (*see* Box 4), we would still be left with perplexing questions about the relatively poor fit between workers' literacy skills and their jobs.

Box 4

Assessing the validity of the "fit" and "mismatch" measures

As noted in Box 3, the operational definitions of literacy–job "fit" and "mismatch" are necessarily somewhat arbitrary. With respect to "mismatch," we have placed in the literacy deficit category those workers whose literacy levels are at least two levels below the literacy requirement level of their job. In turn, we use the literacy surplus category to describe those whose literacy level is at least two categories above their job requirements (we might also call them "under-employed" with respect to their literacy skills). As the shading patterns in Tables 2.8, 2.9 and 2.10 reveal, we could have used either a tighter (three levels above or below) or a broader definition (one level above or below), thus altering the ratio of literacy "fit" to "mismatch." However, in the absence of any other benchmark, we believe that our compromise position is the most reasonable. If there is some self-report bias in these measures, we suspect that it has increased the size of the literacy deficit category and reduced the size of the literacy surplus group. Thus, we would expect workers to over-estimate, not under-estimate, the literacy requirements of their jobs, which would push more respondents to the right-hand side of Tables 2.8, 2.9 and 2.10.

Alternatively, it could be argued that the proportion in the literacy surplus category is inflated because our Combined Reading–Writing Requirements Index (see Box 1) included measures asking about workplace literacy activities that are really very rare. Specifically, only 19% of employed Canadians read or used information daily from diagrams and schematics, and even fewer (13%) wrote or filled out estimates or technical specifications every day (see Table 2.5). Hence, including these two items in the index would increase the proportion of workers with low requirements and, in turn, the proportion in the literacy surplus category. After recalculating the index with these two items excluded, we observed a decline from 21 to 19% in the prose literacy surplus category as some respondents were moved further to the right side of Table 2.8. Similar shifts were observed for document literacy, with the literacy surplus group declining from 21% to 18%. But despite these small shifts, it is clear that our overall conclusions would not change.

One could construct indices from the data displayed in Table 2.5 in many other ways. For example, we might double the weight given to answers of "every day" (i.e., giving them a score of 9 rather than 5) to acknowledge that some high-skill jobs might require workers to repeat the same demanding tasks frequently (rather than a range of tasks less frequently). If we recalculate the literacy requirement indices in this manner, the proportion in the literacy surplus category drops from 21% to 13% for both prose and document literacy. At the same time, the proportions in the literacy deficit category rise to 13% and 14%, respectively. In a sense, we trade one form of "job–skill gap" for another. But even if we accept that this alternative weighting is better (in fact, we consider it more problematic, because it makes most sense to assume that respondents answered with an implicit 1–2–3–4–5 weighting in mind), we are still left with the conclusion that the ***skill surplus*** *problem is every bit as large as the* ***skill deficit*** *problem.*

Box 4 *(concluded)*

Assessing the validity of the "fit" and "mismatch" measures

Although we cannot cite evidence from other sources regarding the validity and reliability of our measures of literacy "fit" and "mismatch," the IALS interview did include several questions asking respondents to rate their reading, writing and mathematical skills for their main job. Using responses to these questions as indicators of the validity of our "fit" and "mismatch" measures, we might hypothesize that those with high skills in high-requirement jobs would be most positive. We might then expect those in the literacy surplus and deficit categories, and those with middle-level skills in medium-requirement jobs, to be somewhat less positive. Finally, we would predict the least positive response from those with low skills in low-requirement jobs.

A test of this hypothesis using the document literacy fit–mismatch classification (Table 2.9) and responses to the question "How would you rate your reading skills in English for your main job?" revealed the predicted pattern of responses. Seventy-eight percent of those in the high–high category answered "excellent", along with 71% in the skill surplus and 69% in the skill deficit groups. In contrast, only 55% of those in the medium–medium category answered "excellent", along with only 34% of those in the low–low category. Similar patterns were observed using our other fit–mismatch classifications and the related self-rating measures. Although additional assessments of the reliability and validity of these fit–mismatch measures would be helpful, these crude tests do give us considerable confidence in the validity of the measures constructed in Tables 2.8, 2.9 and 2.10.

Gender variations

Table 2.11 uses the three "fit" and two "mismatch" categories to examine gender differences. Given that employed women have slightly higher scores than their male counterparts on all three literacy scales (*see* Table 2.2), it is noteworthy that they are much less likely to be using these skills in the workplace.

Table 2.11 **Prose, document and quantitative literacy "fit–mismatch" [1] by gender, employed population, Canada, 1994**

Gender	Worker literacy skills–workplace literacy requirements "fit–mismatch"				
	1 Low–low	2 Medium–medium	3 High–high	4 Low–high (literacy deficit)	5 High–low (literacy surplus)
	%				
Prose literacy					
Total	**17**	**34**	**22**	**6**	**21**
Females	14	36	16	5	29
Males	20	32	26	7	15
Document literacy					
Total	**17**	**33**	**24**	**5**	**21**
Females	15	41	17	3	24
Males	19	27	28	7	19
Quantitative literacy					
Total	**15**	**24**	**29**	**11**	**21**
Females	16	26	23	9	26
Males	14	22	35	12	17

1. *See* Tables 2.8, 2.9 and 2.10 and Box 3 for details on the three fit and two mismatch categories.

To elaborate, for all three dimensions of literacy, women possessing high literacy skills are less likely than men with similar skill levels to be in jobs with high literacy requirements. Instead, women are more concentrated than men in the medium skill–medium job requirements category and in the literacy surplus category. Specifically, women are twice as likely as men to be in jobs that do not require their prose literacy skills (29% versus 15%). For document literacy, one in four women (24%) are in this "under-employed" position, contrasted with 19% of men. Similar gender differences in the skill surplus category (26% versus 17%) are observed for quantitative literacy. Alternatively, on all three literacy dimensions, men are somewhat more likely to be found in the skill deficit category, although the percentage of each sex in this mismatch category is small.

Thus, to sum up, across the various domains of literacy, women are less likely to be using their literacy skills in their jobs. The IALS data are unable to inform us about the specific labour market processes leading to these gender differences. However, it is quite likely that the same combinations of occupational choices and labour market barriers that result in gender differences in occupational location and in earnings distributions (*see* Krahn and Lowe 1998, ch. 4) are responsible for these patterns of skill–job fit and mismatch.

Age variations

There are equally pronounced age variations in literacy fit and mismatch (*see* Table 2.12). For prose and document literacy, workers ages 56 and older are considerably more likely than younger workers to be in the low skill–low requirements and medium skill–medium requirements categories. In turn, these older workers are less likely to be classified as having a skill surplus and are least likely to be in the high–high fit category. These findings invite a number of interpretations.

Table 2.12 Prose, document and quantitative literacy "fit–mismatch" [1] by age, employed population, Canada, 1994

Age group	Worker literacy skills–workplace literacy requirements "fit–mismatch"				
	1 Low–low	2 Medium–medium	3 High–high	4 Low–high (literacy deficit)	5 High–low (literacy surplus)
	%				
Prose literacy					
Total	**17**	**34**	**22**	**6**	**21**
16–25	19	39	12	3	27
26–35	16	38	24	7	15
36–45	15	25	29	5	26
46–55	15	32	20	10	23
56 and older	35	41	10	3	11
Document literacy					
Total	**17**	**33**	**24**	**5**	**21**
16–25	18	31	16	2	33
26–35	12	36	28	4	20
36–45	16	31	29	6	18
46–55	20	30	20	10	20
56 and older	32	43	9	4	12
Quantitative literacy					
Total	**15**	**24**	**29**	**11**	**21**
16–25	13	31	28	13	15
26–35	13	20	33	9	25
36–45	15	23	33	7	22
46–55	18	24	27	13	18
56 and older	15	23	17	21	24

1. *See* Tables 2.8, 2.9 and 2.10 and Box 3 for details on the three fit and two mismatch categories.

The lower proportions of older workers in the high–high category is consistent with the generally lower literacy scores among older cohorts (*see* Table 2.3). The lower proportion in the skill surplus category could be, in part, a function of the lower literacy levels of the oldest cohort (i.e., with lower literacy, they are less at risk of being "under-employed"). It might also reflect upward movement over time for some highly literate workers, into jobs requiring their skills. Alternatively, this pattern is also consistent with the "use it or lose it" argument, because lower proportions of older workers in the skill surplus group might indicate that some who were previously in this category had lost literacy skills (and so moved into a "fit" category).

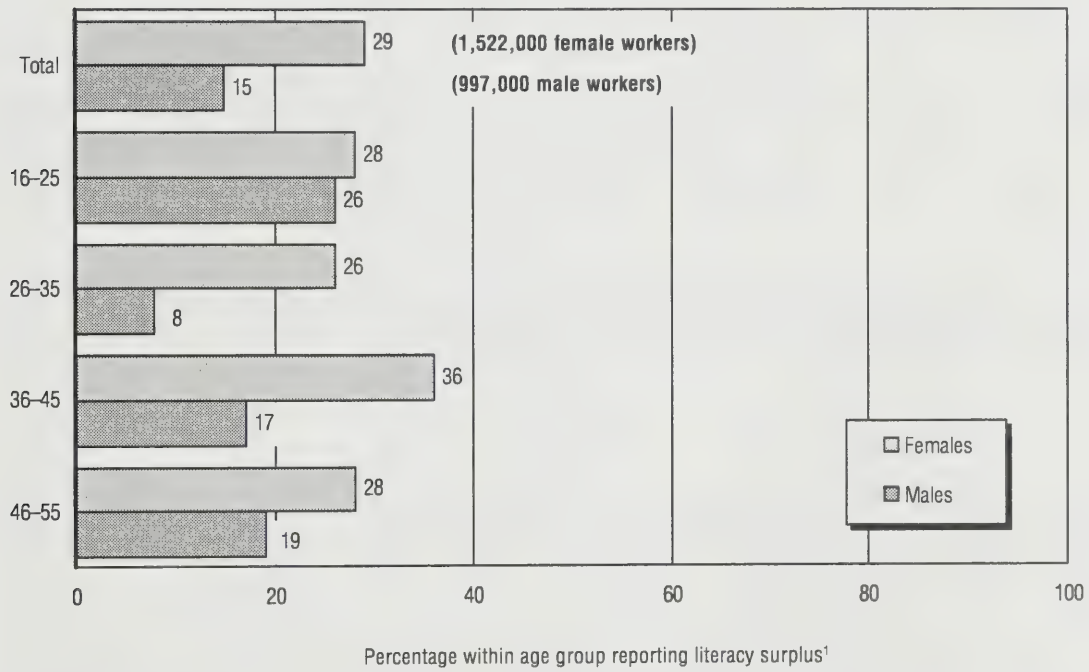
Given the high level of literacy among young Canadians and what we know about some of them having difficulty finding satisfactory employment, we would expect to find high proportions in the literacy surplus category. Table 2.12 reveals exactly such a pattern for prose and document literacy, with 27% and 33% classified this way, respectively. Why the proportions in this category drop sharply for the next cohort (age 26 to 35), and then rise again, is not immediately clear.

Numeracy presents a different picture. On this dimension of literacy, young workers are least likely to exhibit a literacy surplus with respect to their jobs. The explanation may lie in the large proportions of young workers employed in retail trade and in business and personal services, industrial sectors where some level of mathematical ability is required fairly frequently (*see* Table 2.15). In contrast, older workers are more concentrated in the two numeracy mismatch categories than they are for document or prose literacy. Specifically, with respect to numeracy skills, close to one in four of the oldest workers are in the literacy surplus category, whereas more

than one in five—the highest proportion of any age group—are in a literacy deficit situation in their job. Again, the explanation probably lies, to some extent, in the industrial distribution of older workers (a topic not explored in this report). It may also reflect some age–gender interactions, with fewer older women staying in the employed labour force and with women working in distinctly different occupational and industrial locations than men.

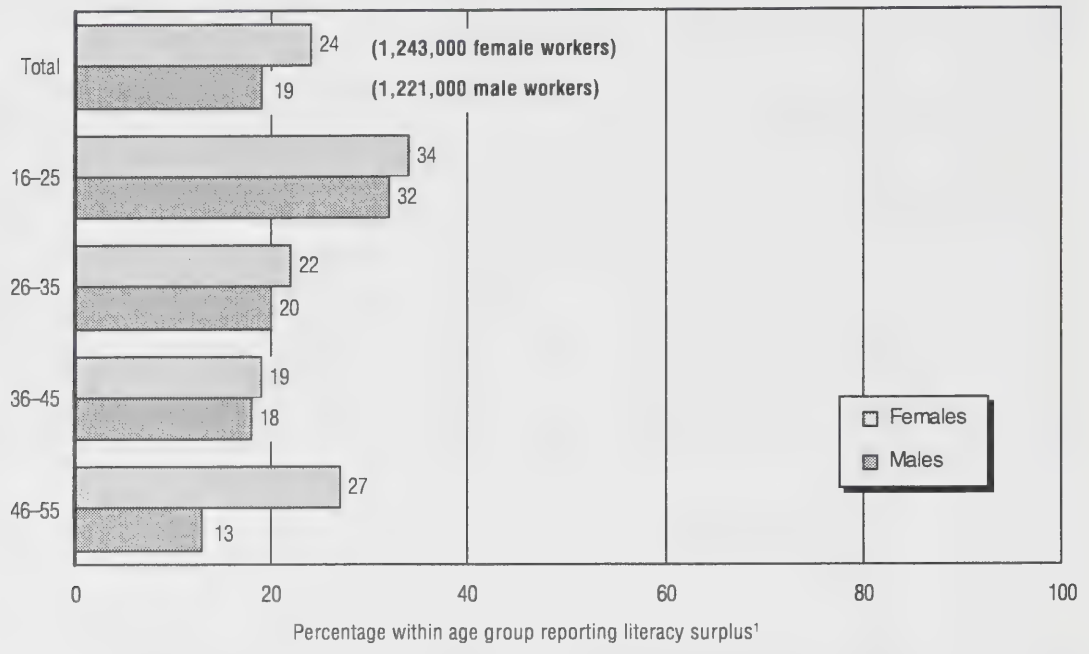
Figures 2.3, 2.4 and 2.5 highlight such gender–age interactions, displaying the percentages of women and men in each age category who fit in the skill surplus ("under-employment") category for each dimension of literacy.[11] We have already noted that women are more likely to be in this category, for each dimension of literacy (*see* Table 2.11). Figures 2.3, 2.4 and 2.5 reveal the same gender difference within each age category. However, the differences are tiny in the youngest cohort (age 16 to 25). For document literacy, the gender difference remains inconsequential until age 45, after which the proportion in the skill surplus category is twice as high for women than for men (*see* Figure 2.4). For prose literacy, a gender difference appears much sooner, within the 26-to-35 year-old cohort, and then remains strong (*see* Figure 2.5). As for numeracy, the gender difference first becomes prominent only in the 36-to-45 age cohort (*see* Figure 2.5). Unfortunately, because of small sub-sample sizes, it is not possible to trace these age–gender interactions further into the gender-segregated labour market they undoubtedly reflect.

Figure 2.3 Gender differences in prose literacy surplus, by age



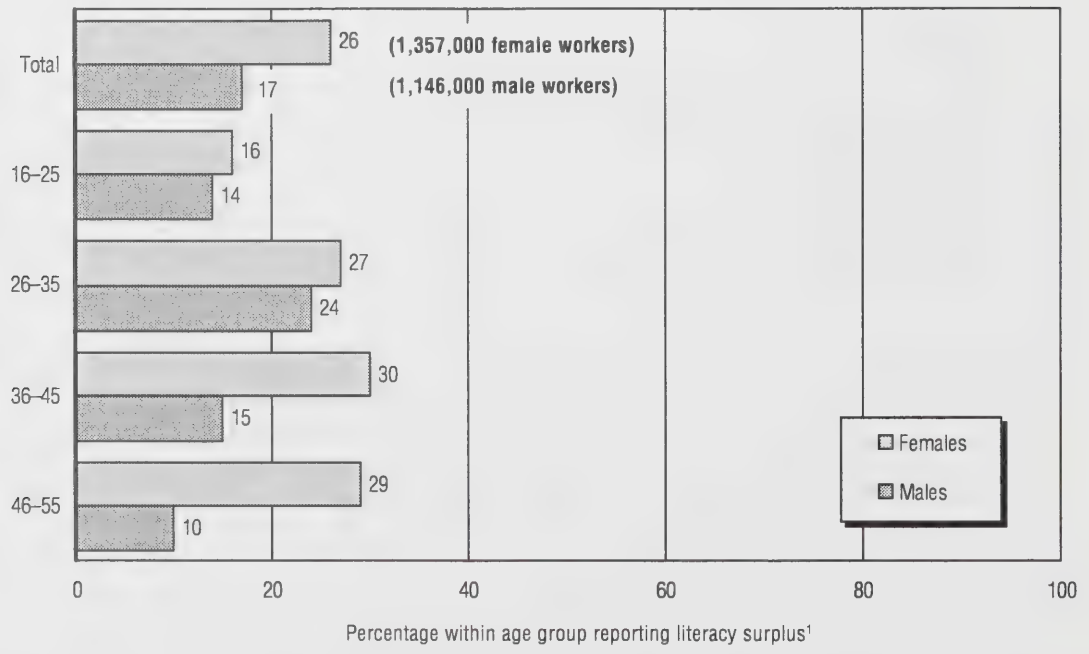
1. Percentage of workers in "category 5" (high prose literacy–low workplace reading–writing requirements) as defined in Table 2.8. There are too few cases in the 56-and-older group to allow reliable estimates.

Figure 2.4 Gender differences in document literacy surplus, by age



1. Percentage of workers in "category 5" (high document literacy–low workplace reading–writing literacy requirements) as defined in Table 2.9. There are too few cases in the 56-and-older group to allow reliable estimates.

Figure 2.5 Gender differences in quantitative literacy surplus, by age



1. Percentage of workers in "category 5" (high quantitative literacy–low workplace numeracy requirements) as defined in Table 2.10. There are too few cases in the 56-and-older group to allow reliable estimates.

Educational attainment variations

As already noted, some of the age patterns of fit and mismatch result from the strong negative relationship between age and education (older cohorts have completed fewer years of formal education). Indeed, in some ways, education appears to be a more consistent predictor of the workplace use of literacy skills than either gender or age.

Looking first at the patterns of skill–job fit, Table 2.13 shows that workers with the least education (up to 12 years) are concentrated in the low–low and medium–medium fit categories for all three literacy dimensions. Workers with 13 to 16 years of education (many of whom would possess either a diploma or certificate from a community college or vocational institute, or an apprenticeship) tend to cluster in the medium–medium fit category for all three types of literacy, as well as in the high–high fit category. University graduates (17 or more years of education) are heavily concentrated in the high–high fit category: between 42% and 48%, depending on the literacy dimension. In short, higher education brings with it higher literacy skills and is also associated with a higher probability of working in a demanding job.

Table 2.13 **Prose, document and quantitative literacy "fit–mismatch" [1] by educational attainment, employed population, Canada, 1994**

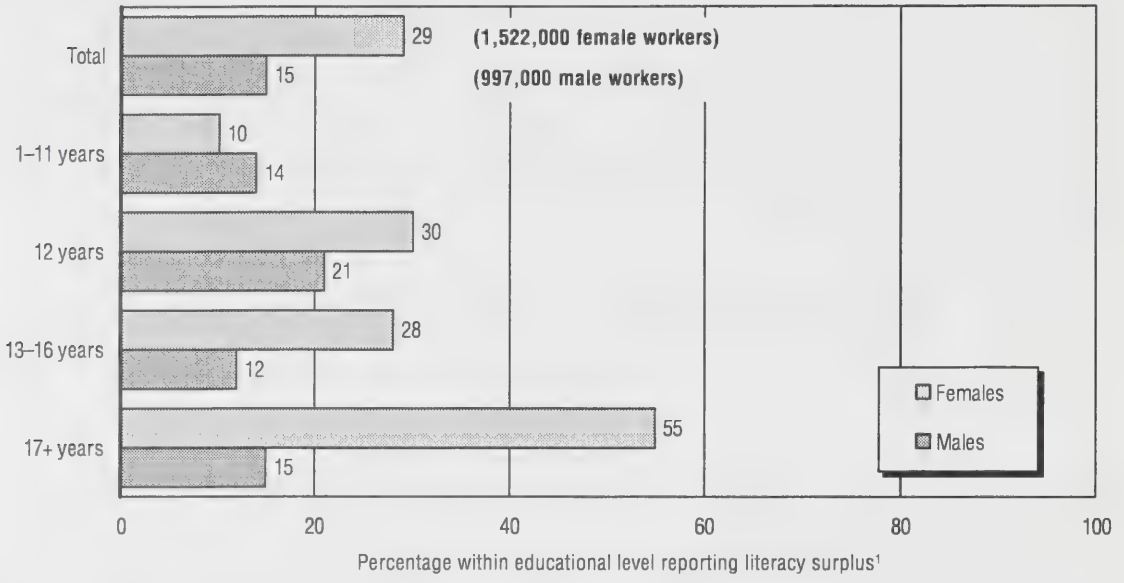
	Worker literacy skills–workplace literacy requirements "fit–mismatch"				
Educational attainment	1 Low–low	2 Medium–medium	3 High–high	4 Low–high (literacy deficit)	5 High–low (literacy surplus)
	%				
Prose literacy					
Total	**17**	**34**	**22**	**6**	**21**
1–11 years	37	32	10	8	13
12 years	27	32	10	5	26
13–16 years	3	45	26	7	19
17 or more years	1	15	48	2	34
Document literacy					
Total	**17**	**33**	**24**	**5**	**21**
1–11 years	44	30	8	10	8
12 years	17	31	15	4	33
13–16 years	4	39	31	3	23
17 or more years	2	29	44	5	20
Quantitative literacy					
Total	**15**	**24**	**29**	**11**	**21**
1–11 years	31	22	13	25	9
12 years	12	28	29	10	21
13–16 years	9	28	37	6	20
17 or more years	3	11	42	1	43

1. *See* Tables 2.8, 2.9 and 2.10 and Box 3 for details on the three fit and two mismatch categories.

Because education and literacy are positively correlated, the odds of being in a literacy surplus situation are low for the least educated, even though Table 2.13 shows that this is possible. For prose and quantitative literacy, the most educated (17 or more years) have the highest probability of being in the skill surplus category (34% and 43%, respectively). In contrast, for document literacy, high school graduates (12 years of education) are most likely to be in the literacy surplus category (33%).

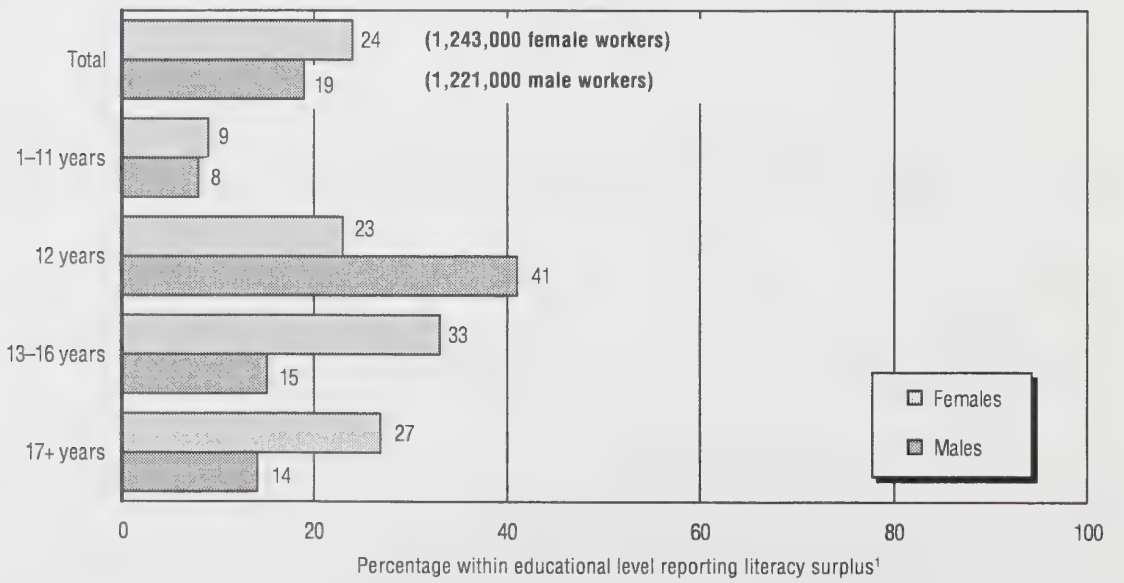
Once again, it is difficult to interpret these complex patterns, because age, gender and occupation–industry location of employment probably all play a part in producing them. We cannot examine detailed multivariate tables because of sample size limitations. However, Figures 2.6, 2.7 and 2.8 add gender to these educational comparisons and so help us understand some of the findings noted above.[12]

Figure 2.6 Gender differences in prose literacy surplus, by educational attainment



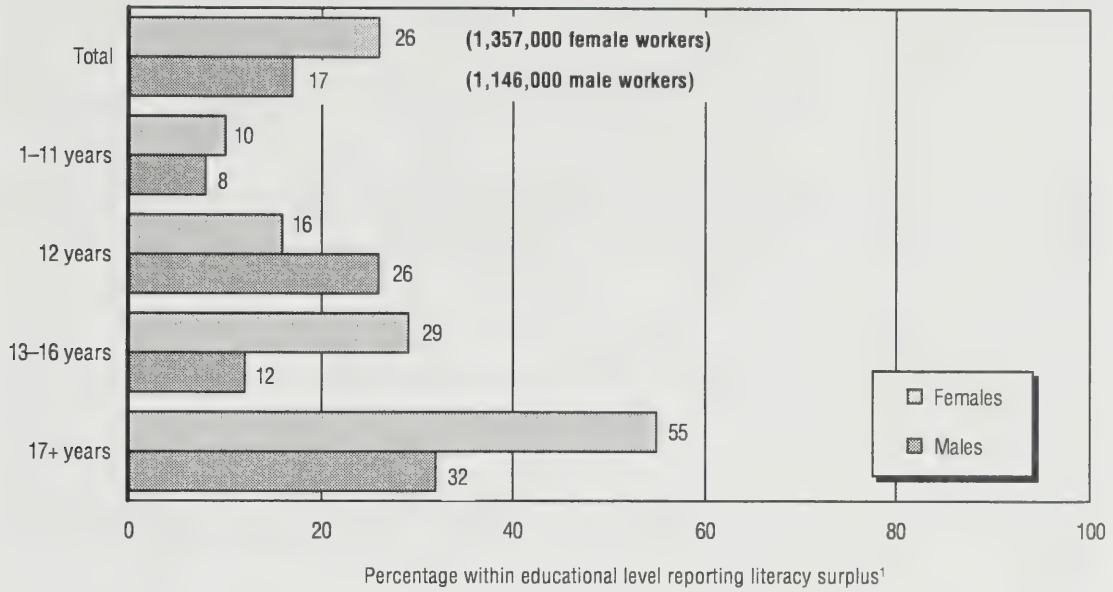
1. Percentage of workers in "category 5" (high document literacy–low workplace reading–writing literacy requirements) as defined in Table 2.8.

Figure 2.7 Gender differences in document literacy surplus, by educational attainment



1. Percentage of workers in "category 5" (high document literacy–low workplace reading–writing literacy requirements) as defined in Table 2.9.

Figure 2.8 Gender differences in quantitative literacy surplus, by educational attainment



1. Percentage of workers in "category 5" (high quantitative literacy–low workplace numeracy requirements) as defined in Table 2.10.

For each dimension of literacy, gender differences in literacy surplus (or "under-employment") are small among those with less than 12 years of education. As already noted, the odds of being in the literacy surplus category are low, at best, for those with limited education, so large gender differences would not be expected. At the other end of the education continuum, we observe that women are much more at risk of being in the literacy surplus group. In fact, more than half of the women with 17 or more years of education are categorized in this manner with respect to both prose (*see* Figure 2.6) and quantitative literacy (*see* Figure 2.8). For Canadians with 13 to 16 years of education, a similar gender pattern of skill surplus is evident for all three literacy dimensions. In short, among the better educated, women are much more likely than men to be working in jobs that do not take advantage of their literacy skills.

Occupation and industry variations

Our interpretations of age and gender differences in "fit" and "mismatch" have tended to be phrased in terms of occupational and industry differences. Table 2.14 examines such differences more closely, using the eight-category occupational and nine-category industrial classification systems introduced earlier (*see* Box 2).

Table 2.14 Prose, document and quantitative literacy "fit–mismatch" [1] by occupation, employed population, Canada, 1994

Occupation	Worker literacy skills–workplace literacy requirements "fit–mismatch"				
	1 Low–low	2 Medium–medium	3 High–high	4 Low–high (literacy deficit)	5 High–low (literacy surplus)
	%				
Prose literacy					
Total	**17**	**34**	**22**	**6**	**21**
Managers	3	34	48	11	4
Professionals	—	27	46	6	21
Technicians, semi-professionals	17	24	22	5	32
Clerical workers	14	61	14	3	8
Service workers	21	34	7	6	32
Skilled craft workers	34	26	11	5	25
Machine operators	29	27	9	10	25
Elementary occupations	35	30	7	3	25
Document literacy					
Total	**17**	**33**	**24**	**5**	**21**
Managers	3	28	54	9	6
Professionals	1	28	49	3	19
Technicians, semi-professionals	4	42	23	2	29
Clerical workers	14	50	15	3	18
Service workers	22	35	13	5	25
Skilled craft workers	31	25	9	8	27
Machine operators	39	24	11	10	16
Elementary occupations	35	30	5	5	25
Quantitative literacy					
Total	**15**	**24**	**29**	**11**	**21**
Managers	2	24	51	13	10
Professionals	9	14	43	1	33
Technicians, semi-professionals	5	20	28	2	45
Clerical workers	13	33	24	11	19
Service workers	17	27	25	16	15
Skilled craft workers	17	23	25	21	14
Machine operators	32	28	18	14	8
Elementary occupations	27	24	21	14	13

1. *See* Tables 2.8, 2.9 and 2.10 and Box 3 for details on the three fit and two mismatch categories.

— Amount too small to be expressed.

Numbers may not add due to rounding.

Beginning with occupational patterns, managers and professionals stand out as having higher odds of being in the high skill–high requirements category for all three literacy dimensions. For example, on document literacy roughly half of managers and professionals have high literacy skills and are in workplaces with high literacy requirements, compared with 23% of technicians and semi-professionals and only 15% of clerical workers. Workers in elementary occupations, skilled craft jobs and service jobs consistently have the greatest concentrations in the low–low fit category, compared with other occupations. There is a tendency for clerical workers to be in the medium–medium fit category, especially on document literacy.

Compared with other occupations, the odds of being in the skill surplus category are highest among technicians and semi-professionals on each of the three literacy dimensions, but they are particularly high for quantitative literacy (45%). This finding seems counter-intuitive, as we would expect technical jobs to involve a greater use of numbers and mathematics. However, this category also contains semi-professionals in the health, education, social services and artistic fields, many of whom might be highly educated and highly literate, but who find themselves in jobs that do not necessarily require these kinds of skills. Again, referring back to our earlier comments about education and gender patterns, many of the incumbents in these fields of work would be women.

For quantitative literacy, professionals exhibit above-average rates of skill surplus (33%). But their chances of being in the skill surplus category are about average for document (19%) and prose literacy (21%). Although these quantitative literacy findings are not all that surprising, given the way in which numeracy requirements were defined (measuring objects and calculating prices; *see* Table 2.5), the fact that one in five professionals falls into the literacy surplus category for prose and document literacy is somewhat unexpected. Similarly, the higher-than-average proportions of skilled and unskilled blue collar workers in the literacy surplus category for prose and document literacy force us to rethink generalizations about a "skills gap" in Canada. Although there undoubtedly are shortages of specific skills in certain occupations (for example, the low rate of quantitative literacy surplus among machine operators), there also appear to be shortages of jobs requiring higher levels of literacy skills.

Industry patterns of literacy fit and mismatch are equally revealing (*see* Table 2.15). Construction, followed by manufacturing and the primary industries, have the greatest concentration of workers in the low–low fit category on prose and document literacy. The latter two industries also have comparatively high proportions in the low–low category for numeracy. However, for quantitative literacy, construction makes somewhat better use of skills with a low rate of skill surplus (only 4%), relatively few in the low–low category (only 9%), and about one-third in the medium–medium fit category. On the other hand, still looking at quantitative literacy, the 29% of construction workers in the skill deficit category is also a cause for concern.

Table 2.15 Prose, document and quantitative literacy "fit–mismatch"[1] by industry, employed population, Canada, 1994

Industry	Worker literacy skills–workplace literacy requirements "fit–mismatch"				
	1 Low–low	2 Medium–medium	3 High–high	4 Low–high (literacy deficit)	5 High–low (literacy surplus)
	%				
Prose literacy					
Total	**17**	**34**	**22**	**6**	**21**
Primary	25	42	6	1	26
Manufacturing	25	28	19	7	21
Construction	40	23	19	7	11
Transportation, communication, utilities	14	29	27	10	20
Trade	15	43	13	8	21
Finance	3	30	42	19	6
Community services	14	29	24	2	31
Business, personal services	19	37	21	4	19
Public administration	6	37	33	8	16
Document literacy					
Total	**17**	**33**	**24**	**5**	**21**
Primary	31	33	8	2	26
Manufacturing	29	20	23	6	22
Construction	40	27	16	6	11
Transportation, communication, utilities	19	26	27	13	15
Trade	16	45	16	4	19
Finance	4	17	57	8	14
Community services	7	38	23	4	28
Business, personal services	18	34	21	6	21
Public administration	5	40	32	7	16
Quantitative literacy					
Total	**15**	**24**	**29**	**11**	**21**
Primary	17	24	23	17	19
Manufacturing	25	23	30	11	11
Construction	9	32	27	29	4
Transportation, communication, utilities	15	20	37	17	11
Trade	13	34	32	14	7
Finance	6	15	48	2	29
Community services	11	20	23	2	44
Business, personal services	19	21	30	14	16
Public administration	8	24	32	8	28

1. *See* Tables 2.8, 2.9 and 2.10 and Box 3 for details on the three fit and two mismatch categories.

Numbers may not add due to rounding.

Generally speaking, the finance industry makes the best use of literacy skills, given its concentration of workers in the high–high category and relatively few workers in the skill surplus category, for both prose and document literacy. But somewhat ironically, even though 48% of finance sector workers are in the high–high numeracy category, almost one in three are in the skill surplus category for this dimension of literacy. Overall, the highest levels of skill surplus (or "under-employment") on all three literacy dimensions are found in the community service industries, which include educational, health and recreational services. Once again, these are sectors within which we find many highly educated female workers, a group that we have already identified as being at greater risk of working in jobs that do not take full advantage of their literacy skills. However, limitations imposed by sample size mean we cannot demonstrate these industry–gender interactions.

Employment status variations

One's employment status also influences the extent of fit or mismatch on the three literacy dimensions (*see* Table 2.16). Focusing on two key indicators—the high–high fit category and the literacy surplus category—we find a fairly consistent pattern. The odds of being in the high skill–high requirement category are much greater for workers with one or more of the following characteristics: extensive supervisory responsibilities, self-employed and employing others, in a full-time job or in a permanent job. By contrast, workers with limited or no supervisory responsibilities, the self-employed without employees or those who work part time or in temporary jobs are more likely to be in jobs where their literacy skills are under-used (the literacy surplus category).

Table 2.16 Prose, document and quantitative literacy "fit–mismatch"[1] by selected employment status indicators, employed population, Canada, 1994

Employment status	Worker literacy skills–workplace literacy requirements "fit–mismatch"				
	1 Low–low	2 Medium–medium	3 High–high	4 Low–high (literacy deficit)	5 High–low (literacy surplus)
	%				
Prose literacy					
Total	**17**	**34**	**22**	**6**	**21**
Employees' supervisory responsibility					
None	24	35	10	5	26
Limited	8	31	37	8	16
Extensive	2	34	47	10	7
Self-employed					
No employees	17	26	19	5	33
With employees	7	38	45	3	7
Full-time job	18	33	23	7	19
Part-time job	15	36	12	2	35
Permanent job	16	35	22	7	20
Temporary job	28	23	16	2	31
Firm size <20	23	29	21	7	20
Firm size 20–99	24	36	17	6	17
Firm size 100–199	33	31	6	2	28
Firm size 200–499	9	41	33	2	15
Firm size ≥ 500	9	35	26	7	23
Document literacy					
Total	**17**	**33**	**24**	**5**	**21**
Employees' supervisory responsibility					
None	24	33	15	2	26
Limited	8	31	36	7	18
Extensive	2	32	43	16	7
Self-employed					
No employees	19	42	12	10	17
With employees	7	28	50	6	9
Full-time job	18	33	25	6	18
Part-time job	15	34	13	2	36
Permanent job	16	34	25	6	19
Temporary job	29	25	12	1	33
Firm size <20	25	33	21	7	14
Firm size 20–99	25	38	15	5	17
Firm size 100–199	11	46	10	2	31
Firm size 200–499	10	39	37	2	12
Firm size ≥ 500	11	28	29	6	26
Quantitative literacy					
Total	**15**	**24**	**29**	**11**	**21**
Employees' supervisory responsibility					
None	22	23	19	9	27
Limited	6	24	42	10	18
Extensive	3	26	40	22	9
Self-employed					
No employees	10	26	41	12	11
With employees	1	10	68	12	9
Full-time job	14	23	31	11	21
Part-time job	18	26	24	8	24
Permanent job	14	23	31	11	21
Temporary job	20	25	20	12	23
Firm size <20	10	23	34	22	11
Firm size 20–99	32	20	28	6	14
Firm size 100–199	6	25	15	4	50
Firm size 200–499	20	33	26	2	19
Firm size ≥ 500	12	23	31	9	25

1. *See* Tables 2.8, 2.9 and 2.10 and Box 3 for details on the three fit and two mismatch" categories.

The relationship between firm (or organization) size and literacy fit or mismatch is less straight forward. Overall, the largest and smallest firms and organizations have more workers in the high–high fit category. Medium-size organizations (100 to 199 employees) consistently have the highest rates of literacy surplus. But also interesting is the way the proportion in this category declines in the next size group, then jumps again in the largest (500 or more employees) firms. But without simultaneously examining industrial location, occupational mix and gender composition of employment for different-size firms—something the IALS data do not permit because of sample size restrictions—we are unable to explain this finding.

Cross-sectional test of the "use it or lose it" hypothesis

Setting up the argument

So far, our analysis of the relationship between workers' literacy skills and the literacy-demands of their jobs has identified some clear patterns of "fit" and "mismatch." Overall, a larger proportion of Canadians are employed in jobs where their skills roughly match (or fit) their job requirements than in mismatch situations. Within the broad workers' skill–job requirements "fit" categories, the proportions employed in both medium–medium and high–high settings is always larger than the proportion in low skill–low requirement situations. Within the "mismatch" categories, however, the larger proportion in a skill surplus (or "under-employment") situation compared with a skill deficit situation (insufficient literacy skills for one's job) forces us to rethink the meaning of the term *job–skills gap*. Furthermore, women, young and middle-aged workers, and the better-educated are more likely to be in the literacy surplus category, prompting concerns about under-used human resources in these groups. There also is a hierarchy of literacy use across industries and occupations.

These findings return us to one of the central questions discussed earlier in this report. Specifically, given evidence of a sizable literacy surplus in the Canadian labour force, what might be the long-term effects on workers' literacy skills of their under-use? Recall that research findings from a number of different areas of scientific enquiry strongly suggested that, without regular use, skills of various kinds might decline. As we argued at the outset, "use it or lose it" might apply equally well to literacy skills of the kind measured in the IALS. Given that the workplace is the major site of literacy use in everyday life for most of the adult population, under-use of the reading, writing and numeracy skills of moderately to highly literate workers could have serious long-term consequences, not only for each as an individual but also for the overall level of human capital in the Canadian labour force. Conversely, it is also possible that workers with lower literacy skills would be challenged to improve these skills if their workplace put slightly higher demands on them, perhaps just short of what we have identified as a state of "literacy deficit."

We have already suggested that, along with cohort effects (older Canadians were less well educated and, hence, score somewhat lower on the IALS), age differences in literacy skills might reflect a "use it or lose it" process. Thus, older people who have not had the opportunity to use their literacy skills may have lost some of the skills they acquired earlier in life. Also, cross-national IALS comparisons provide further indirect support for the hypothesis. Specifically, considerable cross-national variation exists in skilled craft workers' literacy skills and workplace literacy use. Compared with Germany and Sweden, Canada's skilled craft workers are much less likely to be required to perform reading tasks at least once a week (Statistics Canada 1996, 61). Furthermore, only 45% of Canadian skilled craft workers are in Levels 3 or 4/5 on the document literacy scale, in contrast with 60% of German and 74% of Swedish skilled craft workers (OECD/ Statistics Canada 1995, 139). Perhaps the two differences are linked? Perhaps lower literacy use among Canadian workers leads, in time, to a decline in literacy skills?

Such cross-sectional findings cannot establish causality. Undoubtedly, there are societal influences outside the workplace that account, in part, for these cross-national differences. Nevertheless, these findings support the "use it or lose it" hypothesis and encourage further investigations of how workplace literacy might influence workers' literacy skills. A definitive test of the "use it or lose it" hypothesis would require longitudinal data with literacy measured at two points in time, some years apart. Evidence of literacy decline for individuals who had been employed in a low-literacy job or, in the words of Schooler (1984), in a low-complexity environment, would support the hypothesis. So too would be evidence of literacy being enhanced over-time for those who had worked in a more demanding environment. Unfortunately, the IALS data are cross-sectional (one point in time), and so any test of the hypothesis with these data will, by necessity, be more difficult and somewhat less convincing. Even so, we describe such an attempt here.

Multiple regression approach to testing the hypothesis

Our analytic approach is to estimate three multiple regression equations, one for each of the three dimensions of literacy (Tables 2.17, 2.18 and 2.19), thus essentially replicating our test of the hypothesis with three different dependent variables. In each equation, we control on age (measuring cohort effects), education (an important variable in its own right, but also a proxy measure for literacy levels at the time the individual left school) and an index measuring literacy activities outside the workplace. We would predict strong positive effects of education on literacy, negative effects for age and a positive effect for the non-workplace literacy behaviour measure. Also, in each equation we control on gender and as many different aspects of an individual's employment situation as possible (*see* Box 5 for additional technical details).

Table 2.17 **Regression of prose literacy on workplace reading–writing requirements, a "use it or lose it" interaction term, age, education and relevant control variables**

Variables	Unstandardized coefficient *(b)*	Standard error	Standardized coefficient (Beta)	Statistical significance *(p)*
Key independent variables				
Workplace reading–writing requirements index	1.78	1.08	0.03	0.10
Employers in past year × workplace literacy requirements interaction term[1]	–1.93	0.63	–0.05	0.00
Age (six categories)	–5.37	0.77	–0.11	0.00
Education (years)	8.30	0.33	0.48	0.00
Non-work literacy use (three-item index combining library use, letter writing, reading books)	5.57	1.02	0.09	0.00
Control variables				
Gender (female = 1)	10.49	2.05	0.09	0.00
Currently a student (yes = 1)	–6.02	5.32	–0.02	0.26
Work full-time (yes = 1)	–18.16	2.70	–0.11	0.00
Permanent job (yes = 1)	1.53	3.11	0.01	0.62
Weeks worked past year	0.14	0.08	0.03	0.10
Firm size (five categories)	4.38	.60	0.13	0.00
Received training past year (yes = 1)	2.81	0.91	0.05	0.00
Supervisory responsibility (reference category = self - employed with employees)				
Self-employed without employees	–7.55	5.16	–0.03	0.14
Employees without supervisory responsibility	–35.19	4.68	–0.30	0.00
Employees with limited supervisory responsibility	–19.39	4.70	–0.14	0.00
Employees with extensive supervisory responsibility	–30.40	5.07	–0.16	0.00
Industry (reference category = primary)				
Manufacturing	–3.95	4.14	–0.02	0.34
Construction	–17.97	4.94	–0.07	0.00
Transportation, communication, utilities	2.43	4.78	0.01	0.61
Trade	–15.35	4.29	–0.09	0.00
Finance	–24.27	5.30	–0.10	0.00
Community services	–13.47	4.45	–0.10	0.00
Business, personal services	–18.91	4.35	–0.12	0.00
Public administration	–16.23	5.04	–0.07	0.00
Occupation (reference category = managers)				
Professionals	5.73	3.93	0.04	0.15
Technicians/semi-professionals	9.24	4.23	0.05	0.03
Clerical workers	–1.32	3.98	–0.01	0.74
Service workers	–3.55	4.07	–0.02	0.38
Skilled craft workers	3.04	4.19	0.02	0.47
Machine operators	–2.44	4.32	–0.01	0.57
Elementary occupations	4.39	4.70	0.02	0.35
Constant	206.33	9.32		
R^2			0.45	

1. *See* Box 5 for details about this interaction term, as well as the construction of other variables.

Table 2.18 Regression of document literacy on workplace reading–writing requirements, a "use it or lose it" interaction term, age, education and relevant control variables

Variables	Unstandardized coefficient *(b)*	Standard error	Standardized coefficient (Beta)	Statistical significance *(p)*
Key independent variables				
Workplace reading–writing requirements index	2.96	1.16	0.05	0.01
Employers in past year × workplace literacy requirements interaction term[1]	–3.84	0.68	–0.10	0.00
Age (six categories)	–7.76	0.84	–0.14	0.00
Education (years)	7.62	0.36	0.40	0.00
Non-work literacy use (three-item index combining library use, letter writing, reading books)	–0.82	1.10	–0.01	0.46
Control variables				
Gender (female = 1)	–0.58	2.21	–0.01	0.79
Currently a student (yes = 1)	1.02	5.75	0.00	0.86
Work full-time (yes = 1)	–18.31	2.91	–0.11	0.00
Permanent job (yes = 1)	–0.99	3.36	–0.01	0.77
Weeks worked past year	0.33	0.09	0.06	0.00
Firm size (five categories)	6.48	0.65	0.17	0.00
Received training past year (yes = 1)	5.63	0.98	0.09	0.00
Supervisory responsibility (reference category = self - employed with employees)				
Self-employed without employees	–32.19	5.57	–0.13	0.00
Employees without supervisory responsibility	–35.79	5.05	–0.28	0.00
Employees with limited supervisory responsibility	–23.25	5.07	–0.15	0.00
Employees with extensive supervisory responsibility	–31.50	5.48	–0.15	0.00
Industry (reference category = primary)				
Manufacturing	–4.18	4.47	–0.02	0.35
Construction	–29.16	5.33	–0.10	0.00
Transportation, communication, utilities	–2.49	5.16	–0.01	0.63
Trade	–13.44	4.63	–0.08	0.00
Finance	6.73	5.72	0.03	0.24
Community services	–16.29	4.81	–0.11	0.00
Business, personal services	–14.20	4.70	–0.08	0.00
Public administration	–23.16	5.44	–0.09	0.00
Occupation (reference category = managers)				
Professionals	–.64	4.25	–0.00	0.88
Technicians/semi-professionals	1.79	4.62	0.01	0.70
Clerical workers	–7.37	4.29	–0.04	0.09
Service workers	–15.28	4.40	–0.08	0.00
Skilled craft workers	–1.82	4.53	–0.01	0.69
Machine operators	–18.29	4.67	–0.09	0.00
Elementary occupations	–7.30	5.08	–0.03	0.15
Constant	241.21	10.06		
R^2			0.45	

1. *See* Box 5 for details about this interaction term, as well as the construction of other variables.

Table 2.19 **Regression of quantitative literacy on workplace numeracy requirements, a "use it or lose it" interaction term, age, education and relevant control variables**

Variables	Unstandardized coefficient *(b)*	Standard error	Standardized coefficient (Beta)	Statistical significance *(p)*
Key independent variables				
Workplace numeracy requirements index	0.31	0.80	0.01	0.70
Employers in past year × workplace literacy requirements interaction term[1]	−2.79	0.61	−0.08	0.00
Age (six categories)	−3.91	0.77	−0.08	0.00
Education (years)	9.20	0.33	0.52	0.00
Non-work literacy use (three-item index combining library use, letter writing, reading books)	0.72	0.99	0.01	0.47
Control variables				
Gender (female = 1)	1.68	2.03	0.01	0.41
Currently a student (yes = 1)	3.96	5.22	0.01	0.45
Work full-time (yes = 1)	−10.40	2.66	−0.06	0.00
Permanent job (yes = 1)	10.14	3.01	0.05	0.00
Weeks worked past year	0.15	0.08	0.03	0.07
Firm size (five categories)	4.30	0.59	0.12	0.00
Received training past year (yes = 1)	2.11	0.89	0.04	0.02
Supervisory responsibility (reference category = self - employed with employees)				
Self-employed without employees	−22.28	5.08	−0.10	0.00
Employees without supervisory responsibility	−36.19	4.63	−0.30	0.00
Employees with limited supervisory responsibility	−22.79	4.66	−0.16	0.00
Employees with extensive supervisory responsibility	−30.54	5.01	−0.16	0.00
Industry (reference category = primary)				
Manufacturing	4.57	4.07	0.03	0.26
Construction	−14.89	4.84	−0.06	0.00
Transportation, communication, utilities	3.46	4.71	0.02	0.46
Trade	−8.78	4.23	−0.05	0.04
Finance	0.33	5.16	0.00	0.95
Community services	−4.52	4.41	−0.03	0.31
Business, personal services	−13.99	4.29	−0.09	0.00
Public administration	−14.63	4.97	−0.06	0.00
Occupation (reference category = managers)				
Professionals	−3.70	3.88	−0.02	0.34
Technicians/semi-professionals	19.67	4.22	0.11	0.00
Clerical workers	−12.17	3.92	−0.07	0.00
Service workers	−13.78	4.01	−0.08	0.00
Skilled craft workers	−5.30	4.10	−0.03	0.20
Machine operators	−15.24	4.23	−0.08	0.00
Elementary occupations	−8.91	4.59	−0.04	0.05
Constant	204.98	9.29		
R^2			0.48	

1. *See* Box 5 for details about this interaction term, as well as the construction of other variables.

Some of these independent variables (e.g., age, education and non-work literacy use) are factors that influence literacy levels. We want to statistically control on their effect to see if we can detect any additional "use it or lose it" effects of working in a job with limited literacy demands. Other predictors in these equations are really outcomes of literacy (e.g., more and less literate workers might find employment in different types of jobs and in different industries). We control on these variables to hold constant any hiring, promotion or self-selection processes whereby more or less literate workers find their ways into jobs with higher or lower literacy demands. Again, by doing so, we might uncover evidence of a "use it or lose it" effect.

Box 5

"Use it or lose it" multiple regression analyses

Multiple regression analysis techniques (ordinary least-squares) are used to assess the "use it or lose it" hypothesis in this study. For each of the three measures of literacy (prose, document and numeracy), we estimated a multiple regression equation that included:

i) educational attainment (years of formal education completed);

ii) age (in six categories); and

iii) either the Combined Reading–Writing Index or the Quantitative Index (see Box 1), depending on the measure of literacy being examined.

More important for the hypothesis test is a cross-product interaction term constructed by multiplying the relevant workplace literacy requirements index (with its values reflected so that high values indicated low literacy requirements) times a measure of the number of employers that the respondent reported in the previous year (1 = single employer; 0 = more than one employer). With the two component variables coded in this way, high values on the interaction term suggest that the respondent had spent at least a year in a job with low literacy requirements; medium-size values would mean the person's job had higher literacy requirements; and values of 0 would mean that the person had spent less than 1 year on the job (whatever its literacy requirements). Thus, we would predict a statistically significant negative coefficient for the interaction term, controlling on other relevant variables.

Ideally, a measure of time spent in the respondent's current job would be preferable for constructing the interaction term, but the IALS data do not contain such a "seniority" measure. However, recent Labour Force Survey analyses do indicate that, compared to a decade ago, individuals who had spent at least a year in a job were actually more likely to be in a long-term job (Heisz, 1996: 32). We might also have used age as a proxy for seniority, as is often done in econometric analyses. But in this study, age is highly correlated with the dependent variable (literacy) because of strong cohort effects (see Table 2.3). Hence, in equations predicting levels of literacy, the cohort effects overwhelm seniority effects.

Box 5 *(concluded)*

"Use it or lose it" multiple regression analyses

Because the correlations between the two component variables used to construct the interaction term (literacy requirements on the job and number of employers) and the interaction term itself are very high, we run the risks of multi-colinearity producing erratic findings if all three measures are included in the multiple regression equations. In a series of analyses that are not reported, we did discover evidence of multi-colinearity if all the variables were included. However, if the original binary measure of number of employers in the previous year was omitted, the results were stable and interpretable. Hence, the equations reported in Tables 2.17, 2.18 and 2.19 include the pertinent "literacy requirement on the job" index and the interaction term, but not the "number of employers" measure. As expected, these analyses also showed a stronger positive effect of the pertinent "literacy requirements on the job" index before the interaction term was entered into the equation, suggesting that at least some of the additive effect of the literacy requirements measure might result from the hypothesized "use it or lose it" process measured by the interaction term.

Control variables for these multiple regression equations included:

- *i) gender (a binary variable with female coded as "1" and male as "0";*
- *ii) a three-item index (reading books, writing letters, using the library; Alpha = 0.64) measuring the frequencies of non-workplace literacy activities;*
- *iii) a binary measure indicating whether the respondent was a student at the time of the interview (yes = 1; no = 0);*
- *iv) another binary measure indicating that the respondent had received some workplace training in the past year (yes = 1; no = 0);*
- *v) binary measures indicating full-time and permanent employment;*
- *vi) a measure of the number of weeks worked in the previous year;*
- *vii) a five-category measure of firm size;*
- *viii) four binary measures for employment status categories with the "employer" category omitted as the reference category;*
- *ix) eight binary measures for industry with primary industries omitted; and*
- *x) seven binary measures for occupational category, with managers omitted as the reference category.*

Turning to the most important theoretical variables, we are interested in the effects of workplace literacy requirements (either the Combined Reading–Writing Index or the Quantitative Index; *see* Tables 2.6 and 2.7) on literacy levels. Our analyses of literacy fit–mismatch have clearly identified significant proportions of Canadian workers in jobs that more or less match their literacy skills. Hence, we would predict that, controlling on the many other variables in these multiple regression equations, we would find a positive relationship between a measure of workplace literacy requirements and individual literacy scores. Such an effect might indicate support for the "use it or lose it" hypothesis, but it is equally plausible that more literate workers find their way into or are promoted into jobs with higher literacy requirements.

Consequently, we are even more interested in the net effects of a constructed variable that indicates that an individual has spent some length of time in a job with low literacy requirements. In the language of multiple regression, this *cross-product interaction term* (*see* Box 5 for more details) provides the most direct test of the "use it or lose it" hypothesis, namely, that literacy skills will decline if they are not used in one's job. Given the manner in which we have constructed it, we would predict a statistically significant negative coefficient for the interaction term, controlling on other relevant variables. In other words, spending a longer time in a job with low literacy requirements should be associated with lower levels of literacy.

The three multiple regression equations provide limited support for our hypothesis (Tables 2.17, 2.18 and 2.19). As predicted, the interaction term has a significant negative effect on each of the literacy scores, supporting our hypothesis that time spent in a job with limited literacy requirements might lead to some literacy loss. However, the standardized regression coefficients in the third column of the three tables show that the relative size of this effect is very small. Even so, given our cross-sectional (as compared to longitudinal) data, the many other variables controlled in these analyses, the crude indicator of time spent in a low-literacy job (*see* Box 5) and the many other factors that might influence literacy skills that are not even measured in this study, we should perhaps be surprised to even find a statistically significant effect, no matter how small.

The other coefficients in each equation are of less theoretical interest, given the highly focused hypothesis guiding our analysis. Even so, we note that education has strong positive net effects in each equation, as predicted. Similarly, age has a negative effect, although considerably weaker, controlling on the other variables in each equation. The non-work literacy activity index has a significant positive effect only in the equation with prose literacy as a dependent variable. This result is not particularly surprising, because the measures included in this index would be less likely to be related to document and quantitative literacy (*see* Box 5).

"Use it or lose it": Gender differences?

Gender also has a significant net effect only in the prose literacy equation, perhaps because the original gender difference is greatest for this dimension of literacy (*see* Table 2.2). However, because of the strong gender effects we have observed in our earlier "fit" and "mismatch" analyses, including several interesting interaction effects, we extend our multiple regression analysis one step further by estimating separate multiple regression equations for females and males, for each dimension of literacy (Tables 2.20, 2.21 and 2.22). Although all the control variables are still included in these equations, we present coefficients only for the most theoretically interesting independent variables.

It is evident that the literacy scores of men and women are subject to somewhat different influences. With respect to our "use it or lose it" hypothesis, we find it supported for women using prose (*see* Table 2.20) and quantitative literacy (*see* Table 2.22) as the dependent variable, and for men when document literacy is the dependent variable (*see* Table 2.21), but not vice versa. Having not predicted any specific gender differences of this sort, we also do not have a ready interpretation for them. However, when we examine the basic gender differences in literacy surplus (or "under-employment") on each of the three dimensions of literacy (*see* Table 2.11), we observe that, whereas women are over-represented in the literacy surplus category in each case, their odds of being in this category are highest for prose and quantitative literacy. Thus, the significant effects observed in the female multiple regression equations for these two forms of literacy may simply reflect the higher chances of women losing prose and quantitative literacy skills (because more are employed in settings where this could occur). Similarly, men's odds of being in the literacy surplus category are highest for document literacy (*see* Table 2.2), the dimension of literacy for which we find supportive evidence for the "use it or lose it" hypothesis only in the male equation.

Table 2.20 Regression of prose literacy on workplace reading–writing requirements, a "use it or lose it" interaction term, age, education and relevant control variables—separate equations for females and males[1]

	Unstandardized coefficient *(b)*	Standard error	Standardized coefficient (Beta)	Statistical significance *(p)*
Females				
Workplace reading–writing requirements	4.12	1.68	0.07	0.01
Employers in past year × workplace literacy requirements interaction term[2]	–3.35	0.89	–0.09	0.00
Age (six categories)	–3.69	1.16	–0.07	0.00
Education (years)	10.31	0.51	0.55	0.00
Non-work literacy use (three-item index combining library use, letter writing, reading books)	2.36	1.53	0.04	0.12
Constant	190.67	16.57		
R^2			0.49	
Males				
Workplace reading–writing requirements	2.79	1.42	0.06	0.05
Employers in past year × workplace literacy requirements interaction term[2]	0.59	0.88	0.02	0.50
Age (six categories)	–7.92	1.04	–0.16	0.00
Education (years)	6.73	0.44	0.41	0.00
Non-work literacy use (three-item index combining library use, letter writing, reading books)	7.34	1.35	0.12	0.00
Constant	226.94	12.31		
R^2			0.49	

1. The two regression equations in this table contain the same independent and control variables as those reported in Tables 2.17 to 2.19. Only the effects of theoretically relevant independent variables are displayed here; complete equations are available from the authors upon request.
2. *See* Box 5 for details about this interaction term, as well as the construction of other variables.

Table 2.21 **Regression of document literacy on workplace reading–writing requirements, a "use it or lose it" interaction term, age, education and relevant control variables—separate equations for females and males[1]**

	Unstandardized coefficient *(b)*	Standard error	Standardized coefficient (Beta)	Statistical significance *(p)*
Females				
Workplace reading–writing requirements	10.86	1.82	0.18	0.00
Employers in past year x workplace literacy requirements interaction term[2]	–1.59	0.96	–0.04	0.10
Age (six categories)	–3.50	1.25	–0.07	0.01
Education (years)	9.98	0.56	0.52	0.00
Non-work literacy use (three-item index combining library use, letter writing, reading books)	–2.64	1.66	–0.04	0.11
Constant	150.87	17.94		
R^2			0.44	
Males				
Workplace reading–writing requirements	–0.34	1.58	–0.01	0.83
Employers in past year x workplace literacy requirements interaction term[2]	–4.58	0.98	–0.11	0.00
Age (six categories)	–11.11	1.15	–0.20	0.00
Education (years)	6.45	0.49	0.35	0.00
Non-work literacy use (three-item index combining library use, letter writing, reading books)	0.63	1.50	0.01	0.68
Constant	279.16	13.7		
R^2			0.50	

1. The two regression equations in this table contain the same independent and control variables as those reported in Tables 2.17 to 2.19. Only the effects of theoretically relevant independent variables are displayed here; complete equations are available from the authors upon request.
2. *See* Box 5 for details about this interaction term, as well as the construction of other variables.

Table 2.22 **Regression of quantitative literacy on workplace numeracy requirements, a "use it or lose it" interaction term, age, education and relevant control variables—separate equations for females and males[1]**

	Unstandardized coefficient *(b)*	Standard error	Standardized coefficient (Beta)	Statistical significance *(p)*
Females				
Workplace numeracy requirements	–2.38	1.19	–0.06	0.05
Employers in past year × workplace literacy requirements interaction term[2]	–4.55	0.86	–0.15	0.00
Age (six categories)	–1.61	1.14	–0.03	0.16
Education (years)	10.94	0.50	0.59	0.00
Non-work literacy use (three-item index combining library use, letter writing, reading books)	–2.59	1.51	–0.04	0.09
Constant	208.11	16.37		
R^2			0.50	
Males				
Workplace numeracy requirements	3.80	1.09	0.09	0.00
Employers in past year × workplace literacy requirements interaction term[2]	–0.39	.88	–0.01	0.66
Age (six categories)	–6.24	1.06	–0.12	0.00
Education (years)	7.77	0.44	0.45	0.00
Non-work literacy use (three-item index combining library use, letter writing, reading books)	2.34	1.34	0.04	0.08
Constant	212.07	12.62		
R^2			0.52	

1. The two regression equations in this table contain the same independent and control variables as those reported in Tables 2.17 to 2.19. Only the effects of theoretically relevant independent variables are displayed here; complete equations are available from the authors upon request.
2. *See* Box 5 for details about this interaction term, as well as the construction of other variables.

Tables 2.20, 2.21 and 2.22 also highlight a few other interesting gender differences. For example, for each dimension of literacy, age has a stronger net effect on men's literacy scores than it does in the equation for women. As age effects essentially mean cohort effects (older Canadians are less literate because they received less education), we may be seeing stronger effects for men because more older men remain in the labour force.

Equally interesting, education has stronger effects on women's literacy scores than on men's scores, controlling on the many other variables included in the multiple regression equations. The explanation for this gender difference may lie in the manner in which education influences labour market outcomes. Other research has shown that higher education translates into better jobs (as measured by occupation, industry, full-time and permanent status, supervisory responsibilities and so on) at a higher rate for men than for women (Krahn and Lowe 1998, 120). We also have seen that education and literacy are strongly related (*see* Table 2.4). Consequently, in a regression equation with literacy as the dependent variable, and education and a wide range of employment characteristics as independent variables, the stronger correlation between education and employment outcomes for men might mean that the effects of education on literacy are mediated through employment measures (e.g., occupation, supervisory responsibility) for men more than for women. Based on this line of reasoning, we might expect stronger net effects of education on literacy for women, a pattern we observe in Tables 2.20, 2.21 and 2.22.

Chapter 3

Discussion

Interpreting the results

Although more Canadians are employed in settings where their literacy skills roughly match their job requirements, our analyses of the IALS data still reveal a considerable degree of literacy mismatch in the Canadian workplace. Within the mismatch categories, the larger proportion in a *skill surplus* (or "under-employment") situation compared to a *skill deficit* situation (insufficient literacy skills for one's job) forces us to rethink the meaning of the term *job-skills gap*. Also, although the findings are not as definitive, our analyses provide some support for the hypothesis that prolonged exposure to a job with low literacy requirements might lead to some loss of literacy skills. But before highlighting a few of the more specific findings and discussing some of their policy implications, we introduce some cautionary comments about their interpretation.

Literacy, the ability to effectively use textual and numerical information, is essential for full participation in social and economic life. The IALS's prose, document and quantitative literacy scales reliably measure reading, writing and quantitative skills. They have proved to be highly useful for examining literacy fit and mismatch in the Canadian workplace. Yet we also recognize that other skills influence success in the workplace. Although the IALS literacy scales largely reflect formal education and training, the "informal" or "working knowledge" and the "tacit" skills that many workers acquire while working and interacting with co-workers are equally important (Harper 1987; Saxe 1988; Collins, Balmuth and Jean 1989; Damon 1991; Chapin 1995). In fact, non-reading adults sometimes develop surprisingly sophisticated methods of coping with their literacy handicap (Fingeret 1990, 41; Gowen 1994, 37–39). Moreover, the absence of "hard" literacy skills does not necessarily mean a lack of "soft" teamwork and oral communication skills.[13] Particularly in jobs involving extensive customer service, "social skills" often go unrecognized (Gaskell 1991; Holzer 1996). In short, workers' competencies extend well beyond prose, document and quantitative literacy, however crucial these are to labour market success. Hence, when addressing the possibility of a literacy surplus in the Canadian workplace, we must remind ourselves that we are examining only one, albeit extremely important, dimension of the workplace skills equation.

Focusing, then, on literacy requirements in Canadian workplaces, we observed that reading letters and memos is the most common requirement, reported by more than half of all workers as a daily activity. A sizable minority (about 30 to 40%) also engaged daily in various other reading, writing and mathematical activities. Yet, depending on the specific literacy task, between 20% and 60% of workers rarely or never use these literacy skills. Certainly, not all these tasks are required in jobs that otherwise might be considered skilled and intellectually demanding. Indeed, an argument could be made for expanding the 11 IALS measures to capture an even greater diversity of literacy activities. Oral communication of complex information—the stock in trade of customer help-lines, call centres and telephone financial services—exemplifies a form of skilled work that may have only moderate or low literacy requirements by IALS standards. Our findings therefore underscore the need to revisit the definition and measurement of workplace literacy requirements and, at the same time, workplace skills more generally.

Working within the IALS definition of literacy, a useful contrast can also be made between quantitative literacy and the other two dimensions—prose and document literacy. As our analyses reveal, large numbers of jobs require one type of literacy skills, but not the other. The patterns of fit and mismatch are somewhat different. Knowing that quantitative literacy is the strongest correlate of income in North America (Statistics Canada 1996, 12), it is tempting to conclude that it is here where most of our human resource development efforts should be targeted. However, the social and economic benefits of prose and document literacy are not as easily established with a single quantitative measure such as income. There are other ways, beyond pay-cheques, in which the ability to read and write improves one's quality of life. Furthermore, especially for prose literacy, there are many non-work activities that might reinforce this skill set, whereas numerical skills are more likely used mainly in workplaces. In short, it is important to maintain a broad definition of literacy (and skill) that places equal importance on its various dimensions.

Implications of the findings

It is apparent from our analysis of the IALS data that the distribution of on-the-job literacy requirements across occupations is polarized, consistent with other job rewards (e.g., income, benefits, status and training opportunities). Thus, managers have much more challenging jobs on all three literacy dimensions, and professionals have high reading and writing demands. Lower-status occupations usually have substantially lower literacy requirements. "Good jobs" as defined by full-time and permanent status (Economic Council of Canada 1990) also offer more challenging work environments, from a literacy perspective.

Our analysis has gone beyond the literacy requirements of jobs and beyond the more traditional emphasis on workers' literacy skills, to focus on the fit or mismatch between the two, on the issue of literacy use in the workplace. We believe the following to be vital questions for human resource development that have not been satisfactorily addressed in the research and policy discussions on workplace literacy:

- To what extent are workers' literacy skills consistent with reading, writing and numeracy requirements in their jobs?
- Do we more often see a situation characterized by literacy deficits (workers with limited literacy skills) or by literacy surplus (highly literate workers in jobs that do not take advantage of these skills)?
- What are the possible consequences of a poor fit?

Our findings reveal a reasonable fit between workers' literacy skills and their job requirements for about three-quarters of the Canadian labour force. This fit is not surprising, because we would expect that workers with higher skills would, in time, find their way into (or be recruited into) jobs that require such skills whereas those with few skills would not move up. After all, this is the way the labour market is supposed to operate, placing highly skilled workers in positions requiring those skills. Within the "literacy fit" category, however, we still find large proportions of workers in "low–low" and "medium–medium" positions. Assuming our goal is to compete with other nations for the best jobs, both in terms of national productivity and personal rewards for workers, the policy challenge will be to shift more Canadian workers into the "high–high" literacy-fit category (Krahn 1997). Given our definition of the "best jobs," this shift will require both investing in human capital (i.e., literacy skills) and creating jobs with higher literacy requirements. However, it is also apparent that we may need more of the latter, because the Canadian labour force already contains several million workers who appear to be employed in jobs that do not take full advantage of their literacy skills.

Focusing, then, on mismatched workers (individuals in literacy deficit or literacy surplus situations), a theoretical explanation of the size of this group (about one in four members of the employed labour force), is not immediately apparent. Standard theories of labour market operation would, presumably, predict some level of "normal" mismatch, but one in four suggests that the labour market is not sufficiently self-correcting. Furthermore, a labour market approaching equilibrium might be expected to have roughly similar proportions of workers in the skill surplus and skill deficit categories. But our findings show that the former (we might call them "under-employed" with respect to literacy skills) outnumber those in the literacy deficit category by a ratio of about two-to-one for quantitative literacy, three-to-one for prose literacy, and four-to-one for document literacy. We have acknowledged in our discussion of the specific findings that these ratios depend, in part, on the way we measured literacy requirements and determined cutting-points. But even when using different measures and cutting-points the basic pattern remains (*see* Box 4), as do the troubling questions raised by these findings.[14]

Turning from theoretical questions, we ask the following more pressing questions about social and economic costs:

- To what extent do our findings indicate that workers in the literacy deficit category may be having difficulty adequately performing their job tasks?
- Does their form of literacy mismatch translate into costly errors and serious health and safety risks, or just into marginally less productivity?

The IALS data cannot answer such questions. Hence, more research on this subject is clearly required, along with more workplace literacy programs targeted at this group.

Although we cannot directly compare the costs to individuals, firms and the national economy of the two opposite forms of literacy mismatch, it is clear that the literacy surplus (or "under-employment") problem is more widespread, as indicated by the proportion of workers in this category. But previous policy discussions of the "literacy gap" or the "job-skills gap" have focused mainly on the opposite problem, that of workers with literacy deficits. A broader human resource development approach reminds us that there are two faces to this issue. Evidence of significant numbers of Canadian workers who are seldom required to use their literacy skills in their jobs is evidence of under-use of Canada's human resources. Of even greater concern is the potential loss of some of these skills or, in a broader sense, of previous investments in human capital, as a result of literacy under-use (Krahn 1997). Although the cross-sectional test of the "use it or lose it" hypothesis provides only limited support for our argument about potential literacy and human capital loss, the array of powerful evidence from other related areas of research is difficult to ignore. In short, we believe the costs of ignoring a situation of literacy surplus to be severe, for workers, their employers and the larger economy.

So what are the policy implications of our findings regarding a literacy surplus in parts of the Canadian labour force? How can we reduce the prevalence of this form of literacy–job mismatch?

One solution would be to simply acknowledge that there are not enough good jobs and then reduce investments in secondary and postsecondary education to slow the growth of highly educated, and thus more literate, graduates entering the labour market.[15] Alternatively, we recommend that we should concentrate on increasing the skill requirements of jobs. Thus, while literacy enhancement programs are required for some of those in the literacy deficit category (as well as for some workers in the "low–low" literacy fit group), we also need programs that encourage employers, along with their employees and the various organizations that represent them (i.e., unions and professional associations), to seek ways to upgrade the literacy (and other skill) requirements of jobs. This report is not the place to describe such programs—our task has been to document their need—but it is clear that discussions of public policy with respect to literacy must address the issue. To not do so is to ignore a problem with serious human resource and productivity costs (Betcherman and Lowe 1997, 39).

Our findings highlight the extent to which women are over-represented in the literacy surplus category. Also, for prose and document literacy, young workers (who tend to be more highly educated) are more likely to be in jobs where their literacy skills are not fully used. We also observed an interaction between age and gender as, later in the life-course, the odds of women being in the literacy surplus category increase. These patterns of labour market inequality parallel those observed for other job rewards (e.g., income, benefits and job security) and remind us that, whatever the policy responses devised to address literacy mismatch concerns, these responses will have to incorporate concerns about employment equity.

Endnotes

1. For further discussion of the IALS and some of its findings, *see* OECD/Statistics Canada (1995), Statistics Canada (1996), Hardwick (1996), Clark (1996), Crompton (1996), Krahn (1997), Frank (1997), Willms (1997b) and Bloom, Burrows, LaFleur and Squires (1997).
2. In our opinion, this elastic definition is not very helpful, because it mixes "hard" and "soft" skills with personality characteristics and motivations. More useful, perhaps, is the approach taken by Resnick (1991) who extended the definition of literacy beyond the realm of employment, distinguishing between *useful literacy* (required in school, workplaces and for getting through life in general), *informational literacy* (the ability to access and link information, but not necessarily for immediate use) and *pleasurable literacy* (reading as an end in itself).
3. In the German literacy literature, we find the term "second-order illiteracy" being used to describe the loss of skills learned earlier in school (Glass 1990).
4. Similar arguments are advanced in the literature on technological change in the workplace. Introducing new technology into a workplace can result in added learning on the job and the development of new skills (Lowe 1997). However, this potential will only be realized if workers are given greater responsibility and autonomy and allowed to work creatively with the technology (Zuboff 1988). Sometimes this occurs, but we also find examples of computer-literate individuals employed in jobs where these skills are not used (Lowe and Krahn 1989).
5. Focusing on children, Schooler (1984) also described evaluations of "Head Start" programs showing that enriched preschool environments can enhance the psychological functioning (as measured by IQ tests) of children from disadvantaged backgrounds. This research documented long-term effects up to age 12, but not for older children, a reversal Schooler (1984, 267) interpreted as "consistent with the hypothesis that intellectual functioning is negatively affected when environments become less complex and demanding." Schooler also reviewed Rosenbaum's (1975; 1976) study of the effects of tracking in high schools. This research revealed IQ increases for students on the college-track and decreases for those on the non-college track, controlling on initial IQ, sex and social class. Schooler (1984, 268) concluded that "[t]he more complex and demanding the curriculum, the greater the IQ gain; the simpler and less demanding the curriculum, the greater the IQ loss."
6. Throughout this report we present weighted sample estimates of population parameters. Nevertheless, the relatively small size of the IALS sample (5,660 respondents; 2,604 employed when interviewed) requires cautious interpretation of small differences. Significance tests (e.g., analysis of variance for mean differences and chi-square tests for contingency tables) were conducted for all the results presented, using a weighting variable that retained corrections for disproportionate sampling but did not inflate the sample N into a population estimate. We comment on these significance tests only when *non*-significant differences ($p > .01$) are displayed or discussed.
7. For the total population, the gender difference for document literacy is *not* statistically significant ($p > .01$). For the employed sample, the gender differences for document and quantitative literacy are *not* significant ($p > .01$).
8. Although it is beyond the scope of this report, it would be useful to pursue this type of analysis further, examining occupational and employment status differences in literacy requirements within industries and within different-sized firms, for example. Similarly, further research might disaggregate the literacy requirement indices to examine how specific reading, writing and quantitative requirements (*see* Table 2.5) vary by industry, occupation, employment status and firm size.
9. IALS measured generic skills. These workers could, through practice, cope but are deemed to lack skills necessary to deal with equally difficult tasks drawn from unfamiliar contexts.
10. Daniel Boothby drew similar conclusions from his analysis of 1989 LSUDA data but suggested that 3.5 million Canadians with "relatively high levels of reading ability ... [are] working in jobs which make little, if any, call on these skills." (1993, 33). Direct comparisons between his count and ours are not possible, however, because different measures of workplace literacy requirements are used in the two studies. Although we have relied on workers' self-reports about reading, writing and mathematical requirements in their jobs, Boothby classified occupations according to their typical educational requirements, using GED (General Educational Development) scores.
11. Small sub-sample sizes mean that estimates for workers age 56 and older are not reliable. In each of Figures 2.3, 3.4 and 2.5, gender differences (within age categories) of only 2 or 3% are *not* statistically significant ($p > .01$).

12. In Figures 2.6, 2.7 and 2.8, gender differences (within education categories) of 4% or less are *not* statistically significant ($p > .01$).
13. In fact, the coping strategies employed by some less-literate workers actually indicate strong teamwork and oral communication skills. Nevertheless, it is still the case that less-literate workers will not be able to take their informally acquired tacit knowledge and apply it elsewhere as easily as could individuals with formally acquired reading, writing and numeracy skills (Damon 1991, 42-3).
14. Using GED scores to rank the literacy requirements of occupations rather than self-reports of literacy activities on the job as we have done in this analysis, Boothby (1993) drew similar conclusions from his analysis of the 1989 LSUDA data.
15. This appears to be the solution recommended in Britain (under the previous Tory government) where a 1997 Department of Education and Employment proposal called for limitations on the number of entrants to university because "[t]here is a limit to how many extra graduates the economy can absorb before the increased productivity they generate starts to decline." (*The Guardian Weekly,* 16 February 1997, 1).

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Appendix A

Appendix A

The International Adult Literacy Survey (IALS): Methodological overview

The IALS framework

The International Adult Literacy Survey (IALS) was a seven-country (Canada, Germany, the Netherlands, Poland, Sweden, Switzerland and the United States) cross-sectional research initiative conducted in the fall of 1994. Its goal was to create comparable national literacy profiles, by testing literacy proficiency with sophisticated measurement techniques employing stimulus materials from real-world applications. The following discussion provides a brief overview of the methodology used for the IALS; more detail on the study design and measurement techniques can be found in OECD/Statistics Canada (1995) and Statistics Canada (1996).

Literacy is normally taken as a "given" for most adults in our society—few adults are unable to read at all. The IALS does not challenge this reality. But it does question whether most adults can read well enough to give the correct answers on test items that represent the range of difficulty found in tasks that they encounter in their daily lives. The ability to carefully and critically read printed materials while looking for key pieces of information is an essential skill. Thus, the IALS calls into question the very meaning of a "literate adult" in modern society.

As understood in the IALS and in this report, literacy is not a simple dichotomy that distinguishes those who have it from those who do not. Rather, it is a continuous distribution of abilities that depends on the type of information and the complexity of the tasks presented. This understanding of literacy recognizes that *everyone* has some level of literacy skill and proficiency. It acknowledges that the literacy skills of adults are created and maintained, not only by formal schooling, but also by formal and informal workplace training and by applying reading practices and behaviours in daily life.

The IALS is based on a powerful theory of adult reading, one that links reading difficulty to attributes of the text and the task the reader must perform and that reflects the use of literacy in everyday life. The IALS uses Item Response Theory (IRT) and complex testing and scaling techniques to estimate both item difficulty and proficiency. The tests are based on real-world applications; they ask the adults tested to work with materials found in everyday life. For instance, the test materials use labels from medicine bottles, simple invoices and receipts, materials that provide directions to assemble things, transportation schedules, maps, prose articles from newspapers and magazines and items that require simple mathematical calculations.

Few of the literacy measurement items used in the IALS were difficult, but they differed significantly from casual or pleasure reading in that all involved locating and working with specific pieces of information to provide a correct answer. One would hope, for instance, that a person reading a medicine bottle label would be able to determine the proper maximum daily dosage. However, when tested, a surprising number of adults failed to provide the correct answer.

The unique value of the IALS test items comes from their collective capacity to predict, with a high degree of certainty, whether a respondent would be able to handle unfamiliar texts with similar attributes of difficulty. It is this predictability of the unfamiliar that makes literacy such a strategic asset for both individuals and nations, one that allows both to innovate, adapt and learn.

The IALS measured proficiency in three distinct literacy domains:

Prose literacy—the knowledge and skills needed to understand and use information from texts including editorials, news stories, poems and fiction;

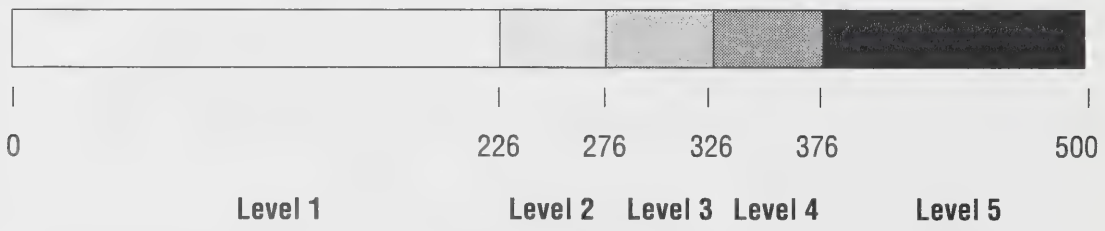
Document literacy—the knowledge and skills required to locate and use information contained in various formats, including job applications, payroll forms, transportation schedules, maps, tables and graphics; and

Quantitative literacy—the knowledge and skills required to apply arithmetic operations, either alone or sequentially, to numbers embedded in printed materials, such as balancing a chequebook, figuring out a tip, completing an order form or determining the amount of interest on a loan using an advertisement.

When tested, IALS respondents were asked to complete a number of literacy tasks within each of the three domains. To be scored at a particular level, respondents had to consistently perform tasks correctly at that level. The threshold for consistent performance was set at 80% of the tasks at a given level. When the results of all the individual measures were combined, the *proficiency scores* for each of the three literacy scales ranged from 0 to 500, with 0 representing the lowest possible ability. Each scale was then grouped into five empirically determined *literacy levels*.

Figure A.1 demonstrates the scale range and illustrates the numerical scale values that define each of the five levels. These values are the same across all three scales. The cutting-points for the five IALS proficiency levels were based on qualitative shifts in the skills and strategies needed to succeed at various tasks along the scales, ranging from simple to complex.

Figure A.1 Literacy range and skill level values



Survey administration

The IALS was conducted in homes by experienced interviewers who administered the literacy tasks in a neutral, non-threatening manner. The survey design combined sophisticated educational testing techniques with those of household survey research to measure literacy and to provide the additional information needed to study the causes and consequences of literacy.

Respondents were first asked a series of questions to obtain background and demographic information on their educational attainment, literacy practices at work and at home, labour force information, their adult education participation and literacy self-assessment. Once this questionnaire was completed, the interviewer presented the respondent with a booklet containing six simple literacy tasks. If the respondent failed to complete at least two of these tasks correctly, the interview was adjourned.

Respondents who completed two or more tasks correctly were given a separate booklet containing a much larger variety of tasks that were selected from a pool of 114 items. These tests were not timed and respondents were urged to try each exercise. Respondents were given maximum leeway to demonstrate their skill levels, even if their measured skills were minimal.

Sample size and weighting

The Canadian component of the IALS sample was drawn from the 1994 *Labour Force Survey* frame. As a result, it excludes residents of the Northwest Territories and Yukon, inmates of institutions, persons living on Indian reserves and full-time members of the Canadian Forces.

The IALS was designed to produce estimates for several specific sub-populations of particular interest to Canadian policy makers: in-school youth (aged 16 to 24, in school full time); out-of-school youth (aged 16 to 24, not in school full time); residents of Ontario whose mother tongue is French and still understand French; residents of New Brunswick who answered the task booklets in French; seniors (aged 65 and over); and social assistance recipients and Employment Insurance beneficiaries. Consequently, some of these sub-populations were deliberately over-sampled. A weighting factor was then used in the analyses to adjust the total population estimates accordingly.

Table A.1 profiles the distribution of the total sample geographically, whereas Table A.2 does the same for specific age groups.

Table A.1 IALS sample size and population estimates by region

Region	Sample size	Population aged 16 and over
Atlantic provinces[1]	1,535	1,786,424
Quebec	794	5,431,033
Ontario	1,925	8,004,546
Western provinces[2]	1,406	6,085,890
Canada	**5,660**	**21,307,893**

1. New Brunswick, Newfoundland, Nova Scotia and Prince Edward Island.
2. Alberta, British Columbia, Manitoba and Saskatchewan.

Table A.2 IALS sample size and population estimates by age group

Age group	Sample size	Population aged 16 and over
16 to 24	1,193	3,369,904
25 to 44	2,006	9,080,575
45 to 64	1,212	5,749,886
65 and over	1,249	3,107,529
Canada	**5,660**	**21,307,893**

Numbers may not add due to rounding.

Although the first few analyses presented in this report focus on the complete adult population, represented by 5,660 IALS respondents, most analyses are restricted to the employed population, estimates for which were obtained from a sub-sample of 2,604 IALS respondents.

Throughout the report, appropriately weighted population estimates are presented, rather than sample results. However, significance tests based on actual sub-sample sizes were conducted for all the analyses comparing population sub-groups. The results of these tests are reported, in footnotes, if they indicate that the relationship in question is *not* statistically significant ($p > .01$).

International Adult Literacy Survey

Monograph Series

The International Adult Literacy Survey (IALS) was a seven-country initiative conducted in the fall of 1994. Its goal was to create comparable literacy profiles across national, linguistic and cultural boundaries. Successive waves of the survey now encompass close to 30 countries around the world.

The Monograph Series features detailed studies from the IALS database by literacy scholars and experts in Canada and the United States. The research is primarily funded by Human Resources Development Canada. Monographs focus on current policy issues and cover topics such as adult training, literacy skill match and mismatch in the workplace, seniors' literacy skills and health, literacy and economic security, and many others.

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